Report of the
Bureau of Engineering
1925-1926

Department of Public Works
City and County of
San Francisco

M. M. O'SHAUGHNESSY
City Engineer

REPORT

OF THE

BUREAU *of* ENGINEERING

OF THE

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF
SAN FRANCISCO

FISCAL YEAR ENDING JUNE 30, 1926

JAMES ROLPH, Jr. , , , *Mayor*

TIMOTHY A. REARDON
CHARLES E. STANTON
FRED W. MEYER
Board of Public Works

M. M. O'SHAUGHNESSY
City Engineer

O'SHAUGHNESSY DAM

Water is overflowing from the reservoir through the siphon spillway and is being discharged through one of the five-foot valves. The road in the right background leads to Lake Eleanor.

Report of the Bureau of Engineering

DEPARTMENT OF PUBLIC WORKS
CITY AND COUNTY OF SAN FRANCISCO
1925-1926

To the Honorable
The Board of Public Works of the
City and County of San Francisco.

Gentlemen:

I transmit herewith the annual report of the Bureau of Engineering for the fiscal year 1925-1926.

As in the previous years, the amount of street work performed in the city has been one of the outstanding features of the year's work. The total cost of such work performed showed a 20% increase over that of the previous year—the amount of work under private contracts having increased almost 50%. In addition to handling this work, studies have been finished and detailed plans prepared for construction of several projected boulevards and for completion or reconstruction of existing main thoroughfares. In connection with the construction of new highways and widening of others, the purchase of necessary lands and rights of ways has been ably handled by our Right-of-Way Department.

Contracts for several main sewer extensions may be let as soon as money is available to pay for the construction as complete plans and specifications for such work have been prepared.

Investigations and special studies of various problems affecting the physical growth of the City have been made and the results used in our reports and plans for future developments. The work of this office covers not only present day needs but, by looking ahead and anticipating future requirements, it initiates provisions for economically meeting these obligations at the proper time.

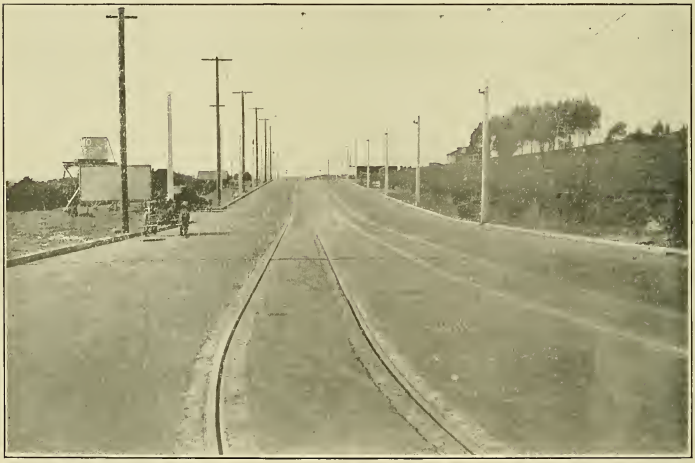
Special reports on extensions for the Municipal Railway system, on construction of the Hetch Hetchy project, and on various special projects have kept your Board correctly informed of the major important developments in connection with the work of this department, while this annual report has been in preparation.

While the plans for the extension of our Municipal Railway system and for the acquisition of a local water supply storage and distribution system have received a temporary setback through the opposition of an ill-advised minority of the voters, we feel that the majority of the citizens realize our programme is for the advancement and development of our City. With their support and with the continuation of the faithful service and loyalty of the employees of this department, we will "carry on" for the future of San Francisco.

Respectfully submitted,

M. M. O'SHAUGHNESSY,
City Engineer.

WORCESTER AVENUE
Before and after improvement of street and construction of Municipal Railway Line.



BOULEVARDS, STREETS AND HIGHWAYS.

The fiscal year 1925-1926 embraced one of the most intensive constructive periods in the City's history; particularly is this true as regards street improvements. This Department handled under public, private and City-pay contracts, street improvements totaling in cost over $2,400,000, representing an increase of 20% over the cost of work performed in the previous year. In addition, surveys and diagrams were furnished for reconstruction work of the Bureau of Street Repair amounting to $742,450.

The center of street improvement activities shifted to the southwesterly section of the City, viz., the Sunset District, the City Land Association and Ocean View Tracts, and new residential districts west of Twin Peaks. Over one-third of the street work completed was in these districts.

One of the largest and most important street improvements of the year was that of Judah Street from 31st to 41st Avenues, which completed the paving of this street throughout its entire length. In conjunction with the paving of the street, rails were laid in this section for the Municipal Railway extension to be completed and operated upon completion of the Sunset Tunnel.

Another important street improvement completed was the Worcester Avenue, Randolph Street and Orizaba Street improvement, which provided a completely paved thoroughfare from Junipero Serra Boulevard through the City Land Association and Ocean View Tracts. The Ocean View Extension of the Municipal Railways was recently completed along this route.

The paving of the extension of Van Ness Avenue from Market Street to Mission Street was of importance as it initiated direct communication between Van Ness Avenue and south of Market street. Traffic conditions at the intersections of Market Street with Van Ness Avenue and with 11th Street have been benefited by this improvement.

A contract has been awarded and construction started on the paving of Fillmore Street from Cervantes Boulevard to Marina Boulevard, which street has been widened in this section to a width of 120 feet with an 80-foot roadway. As the property owners gave the necessary lands for the widening, the City is bearing the cost of the improvement.

Special Treatment Improvements:

Street improvements involving special treatment—walls, steps, double roadways, etc.—have received considerable attention from this Department during the past year. Among such improvements under construction or for which plans were being prepared during this period were:

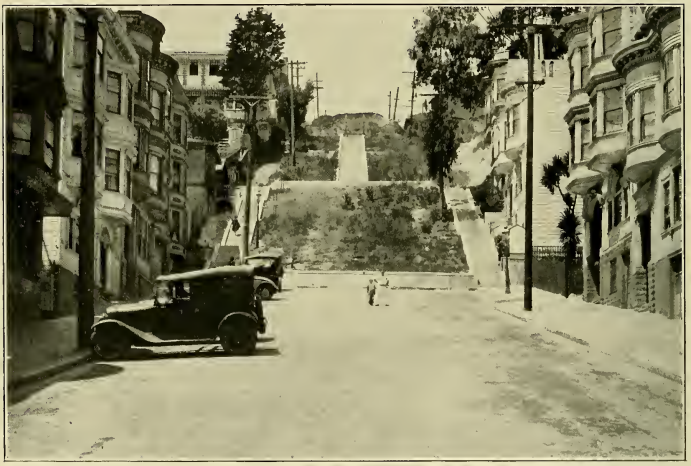
Saturn Street, Ord Street to Lower Terrace.

Vallejo Street, Mason Street to Taylor Street.

Douglas Street, 20th Street to 21st Street.

Vermont Street, 20th Street to 22nd Street.

Alpha Street, Goettingen Street to Tucker Avenue.
Kingston Street, Coleridge Street to Prospect Avenue.
Broderick Street, Vallejo Street to Broadway.
La Salle Avenue, Lane Street to Mendell Street.
Belmont Avenue, Willard Street to Edgewood Avenue.
Elizabeth Street, Hoffman Avenue to Grand View Avenue.
Castro Street, 29th Street to 30th Street.
Peralta Avenue and Tomasa Street.



VALLEJO STREET, BETWEEN MASON AND TAYLOR STREETS
A special treatment improvement.

Market Street Extension:

Plans are ready and a contract for grading and constructing retaining walls and sewers on Market Street Extension from Mono Street to Ord Street will soon be let.

Geneva Avenue:

Plans are being prepared for the paving of Geneva Avenue from Prague Street to the County line by connecting up the paved portion of Geneva Avenue east of Mission Street with the paved section of Walbridge Street in San Mateo County. This will complete a desirable direct cross connection between Mission Street and San Bruno Avenue near the County line, and eliminate the circuitous route heretofore necessary for traffic. A future minimum width of 102 feet is pro-

vided for highway purposes, but for the present only a 20 foot strip will be paved.

Corbett Avenue:

Studies have been made for the realignment of Corbett Avenue from Clayton Street and Caselli Avenue to 24th Street. The property lines are not now parallel nor is the avenue of uniform width, and it is planned to straighten and widen the roadway to produce a good upper level thoroughfare from Ashbury Heights District to the Market Street Extension and Portola Drive.

FILLMORE STREET, CERVANTES BOULEVARD TO MARINA BOULEVARD

Portola Drive:

Surveys are under way and necessary plans will shortly be prepared for widening Portola Drive, from 24th Street westerly, to a width of 100 feet. This is part of the main travelled auto route between Eureka Valley district and the west of Twin Peaks residential tracts, and with the completion of Market Street Extension, now under way, the present 70 foot width will be insufficient.

Golden Gate Heights:

Proceedings have been inaugurated for the improvement of the streets in Golden Gate Heights under public contract. The initial improvement, which is estimated to cost $400,000, will consist of grading and construction of retaining walls and steps, and macadamizing of

roadways, which will suffice until the fills have settled sufficiently for the reception of the permanent pavements. It is hoped that the City will cooperate under a future contract to the extent of paying for the costs of the necessary sewers and drains, estimated at $180,000.

Evans Avenue, Army Street to Islais Creek Lowlands:

Recent developments adjacent to the westerly end of Islais Creek Channel necessitates the opening of a thoroughfare to accommodate the rapidly increasing industrial traffic to and from this district. To accomplish this purpose, a temporary 40-foot roadway was provided by cutting Evans Avenue through the rocky knoll between Army Street and Tulare Street and constructing a wooden bridge to carry the roadway over the Western Pacific tracks adjacent to Army Street. Upon settlement of the fills being made along Evans Avenue west of Third Street, proceedings will be started for the paving of this street, which will then provide a direct cross thoroughfare from the westerly end of Army Street, traversing the Islais Creek industrial district and reaching the Hunter's Point district over the Hunter's Point Boulevard.

Roosevelt Way:

The grading and construction of walls and sewers on Roosevelt Way from 14th Street to Clayton Street were completed. As in other improvements of this character, permanent paving has been deferred until the fills have become stabilized.

Widening Streets:

Reduction of sidewalk widths and consequent widening of the roadway has served to increase traffic facilities on many main thoroughfares. By this method, Geary Street from Van Ness Avenue to Mason Street has been widened 6 feet between curbs. A similar improvement under way will provide another traffic lane for vehicular travel on Kearny Street from Market Street to Columbus Avenue. Also the widening of Union Street from Franklin Street to Steiner Street, and the widening of Clement Street from Arguello Boulevard to Funston Way will be accomplished by narrowing of sidewalks, contracts having been awarded for both improvements. The setting back of curbs on these streets, all of which carry double car tracks, has provided in each case a traffic lane of ample width between the cars and parked vehicles.

Clement Street, easterly from Twelfth Avenue

Union Street, easterly from Laguna Street

TRAFFIC LANES WIDENED BY REDUCTION OF SIDEWALKS WIDTHS

STREET WORK PERFORMED UNDER CONTRACTS

JULY 1, 1925—JUNE 30, 1926

	Quantity	Cost
Asphaltic Concrete Pavement, 6″ concrete base. Wearing surface 1½″, paint coat	393,225 sq. yds.	$1,042,799
Asphaltic Concrete Pavement, with vitrified brick strip, 6″ concrete base.		
Wearing surface 1½″, paint coat	867 sq. yds.	2,340
Vertical fibre brick	467 sq. yds.	2,570
Asphaltic Concrete Pavement, with concrete strip.		
Wearing surface 1½″, paint coat, 6″ concrete base	3,367 sq. yds.	9,089
Concrete Pavement, 6″	2,147 sq. yds.	5,796
Asphalt Pavement, 6″ concrete base.		
Wearing surface 2″	218 sq. yds.	687
Wearing surface 1″, binder 1½″	6,378 sq. yds.	13,662
Asphalt Pavement, with vitrified brick strip, 6″ concrete base.		
Wearing surface 2″	289 sq. yds.	910
Vertical fibre brick	156 sq. yds.	1,036
Asphalt Surface—conform	707 sq. yds.	663
Asphaltic Binder—conform	86 tons	772
Concrete Pavement, 6″	39,356 sq. yds.	113,926
Vitrified Brick Pavement.		
Vertical fibre brick	596 sq. yds.	3,568
Basalt Block Pavement, on sand.		
Gravel and asphalt filler	20 sq. yds.	80
Gravel filler—reset	803 sq. yds.	1,083
Broken Rock Pavement	277 sq. yds.	3,738
Gutters, Concrete	2,640 sq. yds.	7,231
Curb:		
Granite (new)	6,764 lin. ft.	7,188
Granite (reset)	2,627 lin ft.	982
Granite (redressed and reset)	1,483 lin. ft.	3,043
Concrete (armored)	229,358 lin. ft.	245,544
Wheelguards, Concrete	100 lin. ft.	60
Headers, Redwood	400 lin. ft.	200
Sidewalks, Artificial stone	32,769 sq. yds.	59,162
Grading:		
Cut	524,619 cu. yds.	445,771
Fill	118,315 cu. yds.	40,511

Street Work Performed Under Contracts—(Continued).

	Quantity	Cost
Retaining Walls, Stairs, etc.:		
Concrete		$ 54,884
Reinforcing	12.7 tons	1,329
Pipe Railings	798 lin. ft.	3,406
Guard Fence	470 lin. ft.	638
Sewers—Ironstone Pipe:		
6″ (side sewers)	2,393 lin. ft.	2,399
8″	97,830 lin. ft.	83,243
10″	200 lin. ft.	576
12″	9,497 lin. ft.	28,226
12″ (in concrete)	16 lin ft.	72
15″	16,424 lin. ft.	24,384
18″	1,475 lin. ft.	6,263
21″	643 lin. ft.	2,963
21″ (on concrete foundation)	1,394 lin. ft.	8,440
24″ (in concrete)	238 lin. ft.	2,380
Sewers—Cast-iron Pipe, 10″ (Pipe cost not included)	1,210 lin. ft.	4,122
Sewers—Reinforced Concrete:		
5′ Circular	87 lin. ft.	2,006
3′6″ x 5′3″ Eggshaped	670 lin. ft.	11,390
3′0″ x 4′6″ Eggshaped	2,821 lin. ft.	37,959
2′0″ x 3′0″ Eggshaped	2,228 lin. ft.	18,690
Taper, Overflow and Intake Structures	6	1,395
Y—on I.S.P. Sewer:		
On 8‴ sewer	1,985	2,733
On 10″ sewer	13	13
On 12″ sewer	381	631
On 15″ sewer	325	532
On 18″ sewer	59	111
On 21″ sewer	77	426
Underdrain—in rock:		
6″ I.S.P.	56 lin. ft.	63
8″ I.S.P.	90 lin. ft.	63
Manholes:		
On I.S.P. Sewers, new	257	33,427
On I.S.P. Sewers, rebuilt	3	150
On Concrete Sewers	21	1,640
Catchbasins:		
New	319	46,191
Reset	40	2,705
Stormwater Inlets	4	270

Street Work Performed Under Contracts—(Concluded).

	Quantity	Cost
Culverts:		
10″ Ironstone Pipe	10,213 lin ft.	$21,989
10″ Ironstone Pipe in concrete	172 lin. ft.	516
Miscellaneous:		
Miscellaneous Grading, Drainage, etc.		5,685
Total Costs		$2,424,321

Summary—Cost of Street Work:

Work under public contracts	$ 314,031
Work under private contracts	1,875,706
Work under City pay	234,584
Total	$2,424,321

MAJOR PROJECTS AND INVESTIGATIONS

Bernal Cut:

An appropriation of $100,000 was made available for acquisition of additional property necessary for the Bernal Cut improvement. Of this amount, $25,000 has been spent up to the end of the fiscal year and negotiations are under way with other property owners which will soon deplete this appropriation. The total cost of the necessary lands is estimated at $550,000. An additional sum of $135,000 has been allocated for this work during the ensuing year. Descriptions and plats have been prepared for all parcels required and detailed plans of structure bridging the cut at intersecting thoroughfares are being prepared.

The Bernal Cut improvement is an integral artery of the proposed cross-town thoroughfare, embracing Van Ness Avenue, Capp Street, Bernal Cut Boulevard and San Jose Avenue, connecting to the south with the Peninsular Highway. With the widening of San Jose Avenue progressing steadily and the completion of the San Jose Avenue Bridge at Mount Vernon Avenue (as described elsewhere in this and previous reports), the activities of this office will concentrate on the Bernal Cut section of this development.

VAN NESS AVENUE, MARKET STREET TO MISSION STREET

Capp Street Widening:

The proposed widening of Capp Street to a width of 305 feet from Van Ness Avenue Extension to Army Street as a link in a direct low

grade thoroughfare and fire guard through the center of the City has been described in previous reports. Requests have been made by this Department to the Board of Supervisors to promote this project for the near future by prohibiting the construction of Class A and Class B buildings in the street frontage to be acquired which would then have to be purchased and removed.

The following communication bearing on the same subject was addressed to the City Planning Commission on June 10, 1926:

To the Honorable,
City Planning Commission,
City and County of San Francisco.
Gentlemen:

It has been brought to my attention that your Commission has been receiving a number of requests for the rezoning of Capp Street, westerly side, from residential to light commercial or business district.

As you are probably aware, this office has consistently advocated the Capp Street Widening Project, which means the acquisition of a tract of land one lot deep on each side of Capp Street from Van Ness Avenue extended to Army Street.

You are probably already familiar with the details of this proposed improvement, also its function as a transportation facility in connection with the development of our City, the Peninsula, and the Mission District. It involves an approximate length of 8,600 feet, and no grade thereon exceeding 2½ per cent.

It is proposed to reserve within this area a central strip 58 feet in width for a reinforced concrete elevated structure to take care of rapid transit for the Peninsula in the future. It is also proposed to have a two-way traffic artery comprising a 70-foot driveway on each side of this elevated structure in addition to the customary walks and parking areas.

The cost of acquiring residential properties at this time approximates $6,000,000, but this is moderate compared to the estimated cost of $30,000,000 for building a 4-track subway down Market Street from Castro Street to the Ferry.

It is hoped that this Capp Street area will be reserved for the rapidly developing needs of the City's transportation and in order to preserve such an area for this purpose it is imperative that no further business encroachment be made upon this area.

It is also the intent, as needs develop, to bore through the Bernal hills with a tunnel directly south and in line with Capp Street, also to span the Islais Creek section with a viaduct and by following the contours of the lands directly south of the Islais Creek section to tie into both existing and future highways and rapid transit lines. It is also possible, by reaching north of the Capp Street Widening Project at Van Ness Avenue extension, to project further transportation facilities to the down town district.

I recommend, after full consideration by your Commission, that you go definitely on record with a further recommendation from your Commission to the Board of Supervisors as being in favor of this project, so that further conflict on account of zoning requests will be eliminated.

It is not contemplated that this project shall be immediately completed, but rather that we shall be put on record and appropriations be made annually from time to time as may be necessary to prevent its

being lost for all time. The recent conflagration at Ewing Field as well as the experiences in the 1906 disaster demonstrate beyond question the great further value of a fire guard that this project will serve in case of a great conflagration in the wooden section of our City.

I think it would be well also to bear in mind at this time that no immediate expenditure is necessary. Apparently all property owners residing on this thoroughfare are desirous of maintaining their residential status but would not be averse to having their entire frontage taken for boulevard purposes instead of being spotted here and there for both residential and business purposes. Respectfully,

M. M. O'SHAUGHNESSY, City Engineer.

Islais Creek Reclamation:

As previously reported, the Islais Creek Reclamation District, provided for by the State Legislature, April 6, 1925, has been formed. Messrs. Colbert, Caldwell, M. M. O'Shaughnessy and Stuart F. Smith were appointed trustees to serve the district. To test the legality of the Reclamation Act applying to the Islais Creek District, a suit has been instituted by a property owner.

In cooperation with the Chamber of Commerce and the Board of Harbor Commissioners, this office at various times has prepared reports for the proper presentation by the Trustees to the U. S. Government of the needs of the Islais Creek Reclamation District, with special reference to the Government's part in dredging the shoal at the mouth of Islais Creek and the discharge of the dredged materials onto the lands to be reclaimed.

The report presented to the Government by Congressman Richard J. Welch (then Supervisor) at Washington, D. C., in April, 1926, received favorable consideration by the Board of Army Engineers and a recommendation was made to Congress for an appropriation of $146,000 toward the cost of dredging the shoal at the mouth of Islais Creek. With this appropriation the U. S. Government will accomplish the dredging of the flared approach to the Channel and also the shoal southerly therefrom, involving a total of 2,091,000 cubic yards of material at a cost of approximately 7 cents a yard. The Reclamation District will pay the cost of the balance of dredging and assumes all costs of the rubble wall north of Islais Creek Channel, west of Third Street, and of the temporary main sewer.

Surveys of the 280 acres involved in this work are now under way so that a report outlining plans for the proposed work and necessary estimates of costs to start the project may be submitted to the Board of Supervisors without delay.

Bay Shore Boulevard:

Drawing of detail maps of the Bay Shore Boulevard has been under way. Practically all of the necessary lands from Potrero Avenue to Marengo Street have been purchased. Descriptions of all the right of way are being made up so that all needed property may be acquired be-

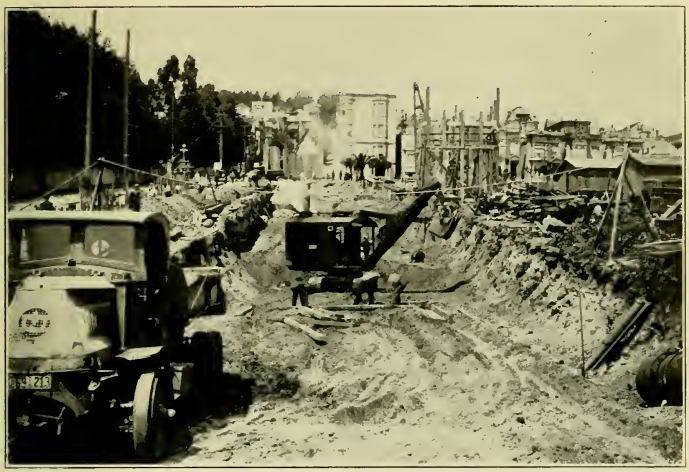
fore buildings are located along the line, as the route traverses a district which is rapidly being taken over by industrial firms. An appropriation of $100,00 made in August, 1925, and the sum of $135,000 to be made available during the coming fiscal year will provide funds to carry on this program. The total appraisal of lands to be acquired is approximately $850,000.

Bids for constructing the undercrossing under the Southern Pacific Railroad tracks at South City in San Mateo County are to be opened July 19, 1926. This structure is estimated to cost $240,000.

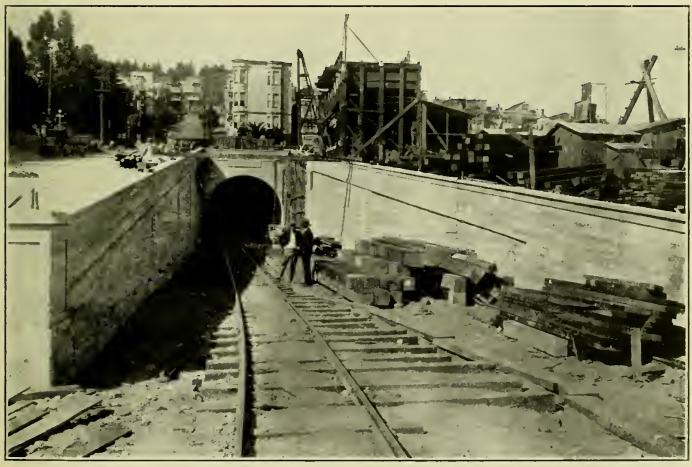
Alemany Boulevard:

The right of way of the defunct Ocean Shore Railroad from San Bruno Avenue southwesterly to the County line was purchased by the City for highway purposes. The original right of way varied in width from 60 to 80 feet and adjoining properties necessary for a 100-foot wide highway are now being acquired. The roadway will be extended on the east to Islais Creek docks and will provide a traffic artery on an average 2%, or less, grade from the industrial district to the potential residential territory south of Lake Merced lands, and will be a cross connection between the Bay Shore Highway, Bernal Cut Boulevard and Junipero Serra Boulevard.

Considerable progress has been made on the plans for this improvement. Survey lines have been run; descriptions of the properties required prepared; grade studies have been completed, and plans and cross-sections are being prepared.



Starting construction—excavation at east portal.



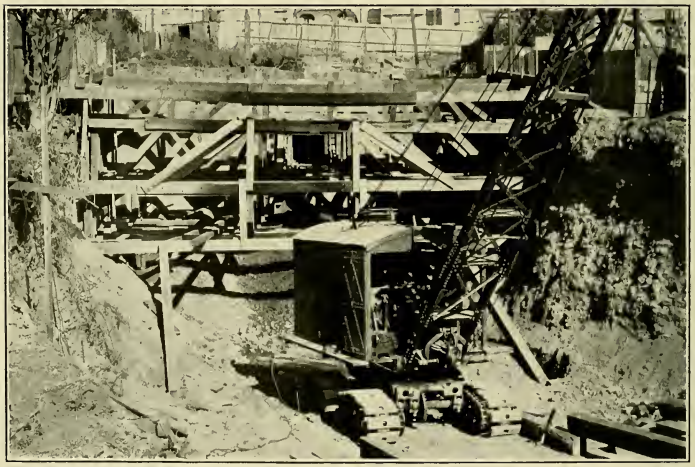
East portal and concrete approach walls.
SUNSET TUNNEL (DUBOCE AVENUE ROUTE)

STRUCTURES AND MISCELLANEOUS CONSTRUCTION

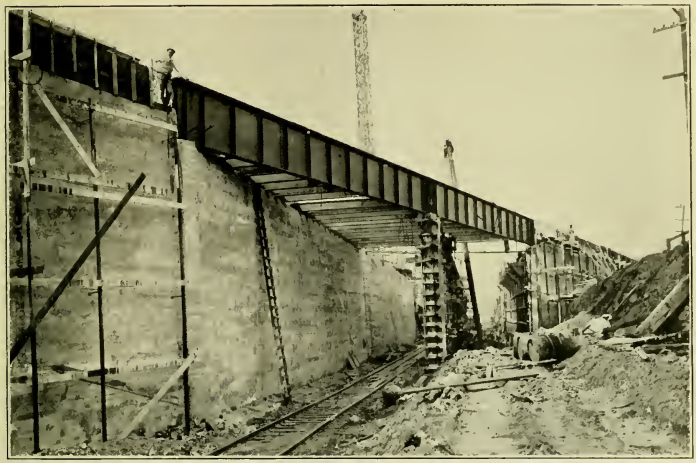
Sunset Tunnel:

On May 5, 1926, seven bids for the construction of the Sunset Tunnel (Duboce Avenue Route) were received: that of the Youdall Construction Company, $1,247,592, being the lowest, the contract was awarded to that company on May 10th. Ground breaking ceremonies were held on June 1, 1926, and actual work on the tunnel commenced.

Previous to this, a suit instituted by opponents against the proceedings, which had been pending in the Superior Court, was decided in favor of the City, thus clearing the way for the collection of the assessment and ordering of the work. December 31, 1926, was fixed as the last date for payment of assessments and on January 7, 1926, the Tax Collector reported that $568,608.36 in cash had been received. On March 10th the Mayor approved Ordinance No. 6998 (New Series), "ordering the construction of a tunnel with approaches and appurtenances thereto, under the elevation whereon is situated Buena Vista Park in the City and County of San Francisco, State of California, and authorizing and directing the Board of Public Works to enter into contract or contracts for such construction and to purchase and acquire said lands and easements." This was the concluding step and successful termination of a long and hard fought struggle for the accomplishment of a major improvement—one which in its importance in the growth of the Sunset District is second only to the construction of the Twin Peaks Tunnel.



SUNSET TUNNEL (DUBOCE AVENUE ROUTE)
Excavation and timbering at west portal.

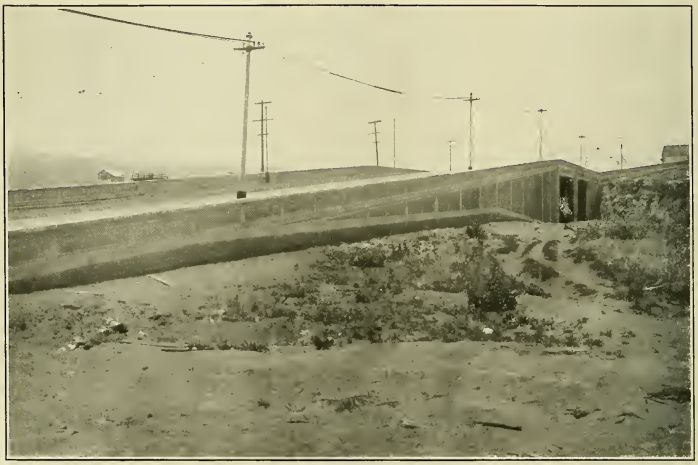


Four plate girders 69 inches in depth, each 54 feet 8 inches in length, carry the street across railroad tracks.

Completed spans over railroad tracks.
SAN JOSE AVENUE BRIDGE

San Jose Avenue Bridge:

The reinforced concrete and structural steel bridge carrying San Jose Avenue over the Southern Pacific tracks at Mount Vernon Avenue, as described in detail in the annual report of 1924-1925, has been completed with the exception of the pavement over the heavy fills. The structure cost $103,578.11, of which the City contributed $93,500; the balance being paid from the sum of $25,000 set aside by the Market Street Railway for that Company's share of the cost and for the reconstruction and paving of their tracks over the bridge and approaches.



SAN JOSE AVENUE BRIDGE
General view of completed structure.

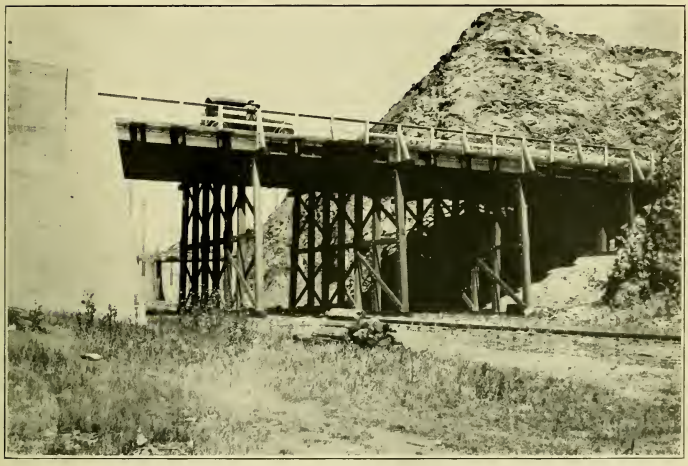
Movable Bridges:

The movable bridges over Islais Creek and Channel Street have been maintained under the supervision of this office. Automatic traffic gates and warning signals were installed on Third Street at the Islais Creek Bridge. Navigation lights were also installed on the bridge in conformity with the government regulations. The lower portion of the structural steel on this bridge, subject to immersion at high tide, was painted.

New fender piling, piers and dolphins were constructed under contract at the Fourth Street and Sixth Street bridges over the Channel. Repairs to the revolving carriage of the Sixth Street Bridge were made in accordance with the plans and specifications issued from this office.

Evans Avenue Bridge:

A timber bridge was constructed on Evans Avenue at Army Street spanning the Western Pacific Railway tracks, which at this point are in cut parallel and adjacent to the south line of Army Street. This bridge, 36 feet in width and 100 feet in length, having four 22-foot spans and one 14-foot span, on timber bents with concrete piers, was built at a cost of $5,251. The bridge gives access from Potrero Avenue and Army Street to the thoroughfare along Evans Avenue through the Islais Creek industrial district and thence over to Hunters Point Boulevard, as previously mentioned in this report.



EVANS AVENUE BRIDGE
Timber structure over railway tracks giving access to Islais Creek industrial district.

Street Signs:

The marking of the main thoroughfares and business streets throughout the City with street signs was carried on during the year by the erection of 526 type "A" signs and 138 type "B" signs, under contract. The type "A" sign consists of 4 porcelain name plates in frames erected on pipe standards at main intersections. The type "B" sign is a single porcelain name plate with a wooden backing, which is placed on a building or improvement on a narrow street or alley.

A total of 2,349 type "A" signs and 411 type "B" signs have been erected under contracts during the past 5 years. It is estimated that the appropriation of $10,000 predicated in the budget allowance for the com-

ing year will permit the erection of approximately 540 type "A" and 150 type "B" signs, with a balance sufficient to cover costs of repairs and painting, where necessary, to existing signs.

Safety Zone and Traffic Lane Appurtenances:

With the increase in automobile traffic on our streets, it has been necessary to provide means, as far as possible, for safeguarding pedestrian traffic across streets and at car stops. Traffic lanes have been laid out at street intersections and safety stations marked off at the street car stops. At the request of the Traffic and Safety Committee, this department prepared plans and specifications for the installation of 11,000 markers, defining pedestrian lanes at crossings, and also for safety zone buttons to be placed at car stops. The installation of the markers in the principal downtown streets and some of the main neighborhood business sections has been completed under contract. A contract for installing the buttons has been recently awarded and work is now under way.

An experimental post type of safety station was constructed on Market Street, on the solicitation of the Down Town Association, which paid the major portion of the installation. This department has been observing with interest the working of this station as no where else but in Detroit is a similar construction permitted.

DOUGLASS AND 26th STREETS PLAYGROUND
Showing adaptation of old quarry for playground purposes.

Douglass and Twenty-sixth Streets (City Lands) Improvement:

Bids have been called for on the improvement of City land at Twenty-sixth and Douglass Streets, embracing the old quarry site at this location, for temporary use as a playground. Plans and specifications, prepared by this department and approved by the Playground Commission, call for leveling the quarry floor, constructing drainage gutters, and enclosing the playground with a galvanized iron wire fence over the high bluffs surrounding the quarry.

The establishment of a large stadium at this location, as advocated by the Playground Commission, would involve extensive excavation. The material encountered is an excellent hard rock, commercially useful, and could be removed by the "glory hole" method of excavation without danger or annoyance to the surrounding neighborhood.

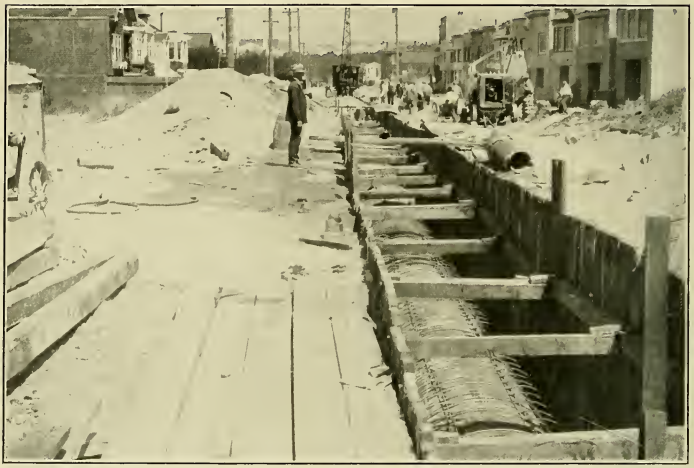
Spanish War Memorial:

Traffic conditions at Van Ness Avenue and Market Street, resulting from the extension of Van Ness Avenue from Market Street to Mission Street, necessitated the removal of the Spanish War Memorial from this location. Under specifications issued from this office, the monument was removed to a commanding position in the central island park on Dolores Street just south of Market Street. Acknowledgment is herein gratefully made to Mr. August Schnepf and to the late Father McQuade, who aided in selecting the new site and in securing the consent of the Spanish War Veterans to the relocation of this memorial to their comrades.

SEWERS

Sunset District Sewers:

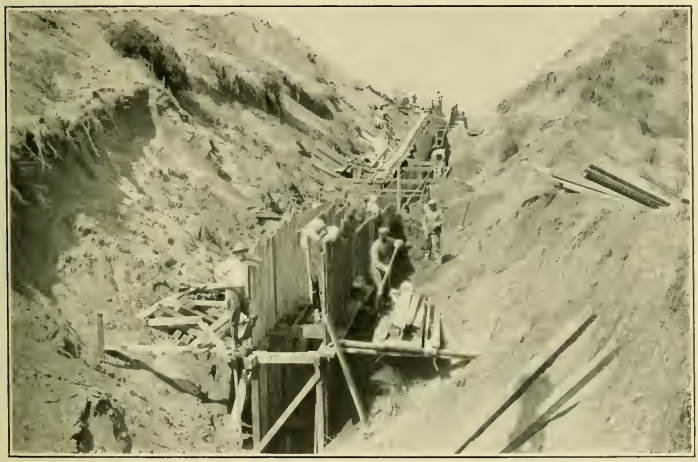
With street improvement activities centering in the central and western portion of the Sunset District, it became necessary to extend the main outlet sewer into this area. The Sunset District is drained by seven main sewer laterals, intercepted by the sewer on Lincoln Way—the northern edge of the district. The dry weather flow is divided: part is diverted across the Golden Gate Park from Thirtieth Avenue to Baker's Beach outlet; the remainder being led into the main Forty-eighth Avenue sewer



WESTERLY SUNSET DISTRICT SEWER, FORTY-THIRD AVENUE MAIN
Section "A"—Constructing 5'-6" circular sewer on Forty-third Avenue

across the Park and pumped from Fulton Street and Forty-eighth Avenue to the Baker's Beach outlet. The storm flow of the district is carried across the Park in the Forty-eighth Avenue main and thence diverted through Mile Rock tunnel to an outelt into the Pacific Ocean. In previous years the intercepting sewer on Lincoln Way and the main laterals tapping the eastern, southern and western edges of the district had been constructed, leaving the central portion not sewered. Work on the two laterals draining this central area—the Sunset Central District Main and the Westerly Sunset (Forty-third Avenue) District Main—was commenced during the past year. A portion of the Sunset Central Sewer

from Twenty-third Avenue and Lawton Street to Thirtieth Avenue and Lincoln Way was completed during the past year. Over 5,400 feet of concrete sewer, ranging in size from 2 foot by 3 foot to 3 foot 6 inch by 5 foot 3 inch, was constructed. Further extension of this sewer to Twenty-ninth Avenue and Ortega Street, and along Noriega Street to Twenty-fourth Avenue, will be undertaken during the coming year, as applications for improvement of the contributing area are on file. The Westerly Sunset (Forty-third Avenue) District Main commences as a 2 foot by 3 foot concrete sewer at Eighteenth Avenue and Santiago Street and, gradually increasing in size in its three miles of length, empties into the



WESTERLY SUNSET DISTRICT SEWER, FORTY-THIRD AVENUE MAIN
Section "B"—Excavating for 2'-6"x3'9" egg-shaped sewer on Santiago Street

Lincoln Way sewer at Forty-third Avenue as a 5 foot 6 inch circular sewer. As sufficient funds were not available to complete this sewer, the work was divided in three sections. Contracts were awarded and construction commenced on the two end sections, the demand for paving of the streets traversed by these sections being the greater. The intervening section will be constructed during the coming year, as additional funds are now provided for this work.

Construction was completed on the sanitary outlet sewer, tank and pump houses for the local separate system serving the zone bordering on the Great Highway between Santiago Street and Sloat Boulevard. Two

6 inch pumps connected to 25-horsepower motors were installed in the pump house and are now in operation. The pumps and motors are automatically operated by means of floats and switches and require only occasional inspection and care.

Glen Park District Sewer Extension:

The extension of Elk Street from Chenery Street to Bosworth Street made necessary the relocation of the inlet of the Glen Park District sewer. A new inlet and grating and 90 feet of 5-foot circular sewer were constructed at a cost of approximately $2,500.

Ingleside Sewer Extension:

The Ingleside District sewer, a 3 foot by 4 foot 6 inch concrete sewer, previously discharged just east of Junipero Serra Boulevard into a 24-inch cast iron pipe sewer across undeveloped lands of the Spring Valley Water Company. With the building up of the contributary territory and the consequent rapid runoff of storm waters from the increased paved areas, the 24-inch sewer was inadequate to carry off the peak storm flow. To prevent backing up of the sewage and damage from overflow at a manhole, the 3 foot by 4 foot 6 inch concrete sewer was extended 268 feet across the boulevard, replacing the 24-inch pipe for this distance, and an overflow structure constructed at the new junction so as to permit the excess storm flow to overflow and be carried off in natural drainage channels through the undeveloped territory.

Side Sewers:

On July 1, 1925, a schedule of prices per lineal foot by districts for side sewer installation was put into effect. This replaced the system of collecting in advance an estimated cost of installation with an additional sum collected or a rebate made if the actual cost exceeded or was less than the estimate. Under this schedule, the pipe and cement is supplied by the City, whereas formerly the property owner had to provide these materials.

After the schedule had been in effect for six months, sufficient data was obtained upon which to base more detailed estimates of cost, which resulted in a raise in the prices fixed.

During the past year, 2,772 applications for side sewers were made (many applications covering two or more sewers) and $177,112.37 collected for installing them. While the number of applications received was the same as for the previous year, the collections were less by $36,313.06. This is accounted for by the fact that the previous years' collections were gross collections from which rebates were made later, due to estimates exceeding the determined cost, and also because under the first lineal foot price-schedule adopted and in force over six months, it was found that the sum collected was far less than actual cost.

Side Sewer Installations.

(Under Unit Price per Foot Schedule in effect July 1, 1925, and revised January 19, 1926.)

Date	Number of Applications	Amount Collected
1925		
July	245	$ 13,627.15
August	256	14,347.62
September	274	14,025.75
October	320	17,609.80
November	270	15,792.20
December	215	12,193.00
1926		
January	219	14,193.55
February	173	10,997.05
March	219	18,582.55
April	215	18,360.70
May	197	15,177.75
June	169	12,205.25
Total	2,772	$177,112.37

For many years all side sewers were constructed when the main sewer was completed, but, in many cases, building operations did not follow up the sewer construction and paving, and the side sewers represented an idle investment as many were not used for some time and others could not be located in after years when needed. Because of these facts, the requirement of installing side sewers previous to paving was removed several years ago.

With the rapid building up of the City, whereby buildings are following closely after the paving, it was found that the new pavements, while still green, were being cut for side sewer installations; and a concrete base or pavement, when once cut into, is difficult to maintain. A return to the old system will be made shortly as it is now our opinion that, considering all phases of the problem, the economic loss will be less if side sewers are installed before pavements are constructed even if some are "lost" or not used immediately. In addition the initial cost to the property owner will be less as all side sewers in a block being installed at the same time and before the pavement is laid, a better price can be offered by the contractor than where side sewers are constructed singly and the pavement must be cut.

STREET IMPROVEMENT ASSESSMENTS, ETC.

Assessments and Bonds for Street Work

Assessments issued for cost of street work performed	82
Cost of street improvements covered by assessments	$495,094.73
Bonds prepared (in triplicate)	249
Amount of assessments guaranteed by bonds	$124,256.85
Average amount guaranteed by each bond	$ 499.02

Street Work Proceedings

Resolutions of Intention passed	78
Street improvements recommended under Resolution of Intention	98
Notices of street improvement posted	2,658
Notices of Resolution of Intention mailed	5,759
Ordinances ordering performance of street improvements passed	96
Proposals of street improvements published	121
Public contracts for street improvements awarded	102
Private contracts filed	607

Notices, Permits and Investigations

Notice to construct and repair sidewalks	2,172
Notice to construct bulkheads	561
Notice to remove obstructions	519
Notice to construct guard rails	17
Notice to reconstruct side sewers	381
Street space permits reported on	4,302
House moving permits reported on	137
Miscellaneous calls and investigations	3,211

Permits and Fees for Corporation Trenches, Etc.

(In conformity with Ordinance 2201)

	Service Connections and Repairs	Mains Installed Lineal Ft.	Fees charged.
Pacific Gas and Electric Co.	7,944	67,522	$12,462.00
Spring Valley Water Co.	4,681	34,813	7,308.00
Pacific Telephone & Tel. Co.	517	36,687	1,108.50
Great Western Power Co.	75	3,405	142.50
Western Union Telegraph Co.	5	690	13.50
*Miscellaneous under Special Deposits			5,786.50
Total	13,222	143,117	$26,821.00

*Permits granted for which special deposits were made to move steam shovels and tractors, to repair or install oil tanks, service pipes, fire alarm wires, cables and conduits, to lower curbs, etc.

SURVEYS

Surveys Performed

Made for:	Number	
Public Contracts	117	
Private Contracts	715	
Resurvey for Contracts (lost points)	224	
Municipal Departments	403	
Total for Public Improvements, etc.		1,459
Lot Surveys:		
Private owners	55	
Municipal Departments	25	
Total Lot Surveys		80
Total Surveys		1,539

Surveys include approximately 3,050 blocks and crossings; a total length of 990,000 feet or 187 miles, in addition to 32 miles of monument line and highway work and the replacing of 200 survey monuments.

Precise Levels and Bench Marks

District	Number of Bench Marks	Precise Levels
50 Vara	40	1.70 Miles
100 Vara	118	3.00 Miles
Richmond	182	3.90 Miles
Western Addition	197	4.90 Miles
Bernal Heights	221	6.90 Miles
Potrero	165	4.70 Miles
South San Francisco	816	56.10 Miles
Sunset	113	3.90 Miles
Other Districts	945	20.20 Miles
Total	2,797	105.30 Miles

Maps Approved and Recorded

Southern Hillsides, Unit No. 1.
Monterey Heights, Block 3011.
Monterey Heights, Blocks 3260-3 and 3273-4.
Monterey Boulevard (formerly Circular Avenue), Widening.
Magellan Avenue, Extension, etc.
Diamond Street, Opening.
Carroll Avenue, Widening.
Westwood Highlands, Blocks 3050-3 and portion of Blocks 3038-3056.
Lake Street Extension and Sea View Terrace Opening.
Rousseau Street, Widening.
Mission Street, Widening (amended map).
Monterey Heights, Block 3047 and portion of Block 3077.

Sala's Resubdivision and part of Block 7044.
Portal Heights.
Wells Fargo Bank and Union Trust Company, et al. Property northwest of Portola Drive.
Market Street, Widening (north of Elizabeth Street).
Monument Way.
Dehon and Harlow Strets, closing portion of.
Virginia Avenue, Widening.
Miraloma Park, Subdivision No. 1.
Tonquin Street, Scott to Lyon Streets, Widening.
Eleventh and Market Streets, Widening at southwest corner.
Bannock Street, Opening.
Castenada Avenue, Widening.
Van Ness Avenue, south of Market Street.
Mt. Davidson Manor.
Cervantes Boulevard and Alhambra Street, Realignment.
Hollywood Court.

Fees Received for Surveys and Inspection

1925	Surveys	Inspection
July	$1,443.50	$1,152.00
August	840.00	1,406.25
September	1,163.00	1,187.75
October	1,840.00	2,602.10
November	1,348.00	1,621.00
December	2,165.75	2,868.65
1926		
January	2,009.50	1,477.90
February	1,405.75	2,773.30
March	1,680.00	2,162.25
April	2,280.25	1,884.00
May	1,588.00	1,535.75
June	2,422.50	6,693.75
Total	$20,186.25	$27,364.70

LOCATION	CONTRACTOR	Date of Award	Date Completed	Per cent Completed	Amount of Completed Contract	Amount Expended to June 30, 1926	Fund
BOULEVARDS, PAVING AND GRADING							
Geary Street, Baker St. to Van Ness Ave. (Widening)	City Construction Co.	8/ 8/24	6/ 1/26	100	$20,601.39	$13,601.39-a	General Fund and Special Fund
Sunset Golf Links (Lake Merced) Road (Grading)	H. T. Guerin	10/24/24	7/22/25	100	34,156.74	34,156.74	County Roads
Southern Heights Boulevard (Grading and Walls)	Jas. M. Smith	1/12/25	7/10/25	100	14,175.67	14,175.67	County Roads
Second Street, Harrison to Brannan (Reconstruction)	Eaton and Smith	2/20/25	11/21/25	100	18,718.65	13,567.63-b	General Fund
Fulton, Leavenworth and Market Sts. Intersection (Paving)	C. B. Eaton	3/25/25	8/26/25	100	6,317.01	6,317.01	General Fund
Roosevelt Way, (Grading and Walls)	Schultz Construction Co.	5/11/25	1/26/26	100	67,405.76	67,405.76	County Roads
Fulgas Road, (Grading)	Farrar and Carlin	5/22/25	4/ 5/26	100	42,805.45	42,805.45	Tubercular Sanitarium Fund
Kearny Street, Market St. to Columbus Ave. (Widening)	City Construction Co.	10/23/25		65	17,128.69	3,100.00	General Fund
Evans Avenue, Army Street to Tulare Street (Grading)	James T. Tobin	10/26/25	3/24/26	100	5,045.68	5,045.68	General Fund
Clarement Circle Parking Area, (Paving)	Fay Improvement Co.	11/25/25	5/12/26	100	2,975.00	2,975.00	County Roads
Union Street, Franklin St. to Steiner St. (Widening)	C. B. Eaton	12/11/25		60	15,939.51		General Fund
Clement Street, Arguello Blvd. to Funston Ave. (Widening)	Frank J. McHugh	1/22/26			10,685.46		General Fund and Property Owners
Fillmore Street, Cervantes Blvd. to Marina Blvd. (Paving)	Pacific States Construction Co.	4/ 9/26		50	22,478.55		County Roads
Bluxome Street, 4th Street to 6th Street (Reconstruction)	A. E. Hennessey	6/ 4/26			22,264.08		General Fund and County Roads

a Geary Street Property Owners' Association's Contribution.

b Balance paid by Southern Pacific Company.

MUNICIPAL RAILWAYS								
138	Ocean View Line - Track & Paving	Eaton and Smith	4/10/25	9/23/25	100	$104,917.77	$104,917.77	Mun. Ry Depreciation
142	Ocean View Line - Installing electric Conductors	Robt. W. Jamison	10/ 3/24	1/ 3/25	100	8,236.31	8,236.31	Mun Ry. Depreciation
143	Ocean View Line - Track Bonding	Robt. W. Jamison	5/ 8/25	9/ 1/25	100	3,038.23	3,038.23	Mun Ry Depreciation
144	Track Special Work	U.S.Steel Products Co.	9/16/25	3/26/26	100	42,702.00	42,702.00	Mun. Ry. Depreciation
145	Judah St. - Track Construction	L. P. Brassy	2/ 5/26	6/26/26	100	31,513.16	31,320.00	Mun Ry Depreciation
146	Judah St. - Track Bonding	Robt. W. Jamison	3/ 3/26	6/15/26	100	1,216.15	1,216.15	Mun Ry Depreciation

LOCATION	CONTRACTOR	Date of Award	Date Completed	Per cent Completed	Amount of Completed Contract	Amount Expended to June 30, 1926	Funds
MISCELLANEOUS							
3rd Street & Islais Creek Bridge, Traffic Gates and Signals	Butte Electric and Mfg. Co.	6/17/25	10/ 1/25	100	$ 4,351.30	$ 4,351.30	General Fund
San Jose Avenue Bridge, at Mt Vernon Ave.	Bond Construction Co.	7/31/25	6/ 2/26	100	103,573.11	93,500.00-c	County Roads and Special Fund
Street Signs, Contract #5	Schultz Construction Co.	8/17/25	1/13/26	100	3,948.00	3,948.00	General Fund
Great Highway & Vicente St. Pumping Station, Pumps and Motors	C. U. Martin	9/23/25	5/ 5/26	100	4,374.25	4,374.25	General Fund
Spanish War Memorial, - Removal	Hugh McGill	10/26/25	1/16/26	100	2,365.00	2,365.00	General Fund
4th & 6th St. Bridges over Channel, Piers, Dolphins & Fender Piling	M. B. McGowan	1/15/26	4/20/26	100	2,657.27	2,657.27	General Fund
Evans Avenue Bridge, (Timber Structure)	Frank Bryant	1/29/26	5/ 5/26	100	5,251.15	5,251.15	General Fund
6th Street Bridge, Revolving Carriage	Wm. Speck	4/ 9/26	7/20/26	75	1,845.00		General Fund
Safety Lane Markers, Contract #1, Installation	O. R. Neil	4/14/26	5/12/26	100	829.95	829.95	General Fund
Sunset Tunnel, Duboce Avenue Route	Youdall Construction Co.	5/10/26		1	1,247,592.00		Sunset Tunnel Assessment Fund
Safety Zone Buttons, - Installation	E. J. Treacy	6/ 2/26			2,082.50		General Fund
SEWERS							
Great Highway & Vicente Street, Outfall Sewer	Peter J. McHugh, Jr.	2/ 9/ 25	1/ 6/26	100	40,293.94	40,293.94	General Fund
30th Avenue and Kirkham Street, Sewer	L. J. Cohn	4/17/25	11/ 9/25	100	45,999.00	45,999.00	General Fund
Harding Golf Links Sewer	Spring Valley Water Co.	4/20/25	8/ 5/25	100	11,965.63	11,965.63	General Fund
Kirkham Street and 23rd Avenue, Sewer	Schultz Construction Co.	7/17/25	3/ 2/26	100	13,710.80	13,710.80	General Fund
Ingleside Side Sewer, Extension across Junipero Serra Blvd.	L. J. Cohn	9/28/25	11/25/25	100	5,320.05	5,320.05	General Fund
26th Ave. (Kirkham to Lawton) Sewer	J. N. Ducray	2/24/26	5/24/26	100	6,072 50	6,072.50	General Fund
Glen Park District, Sewer Extension	C. B. Cowden	3/26/26	6/26/26	100	2,455.60	2,455 60	General Fund
Westerly Sunset District Sewer, Sec A, 43rd Avenue Main	C. B. Eaton	4/ 9/26		15	60,925.26		General Fund
Westerly Sunset District Sewer, Sec. C, Santiago Street Main	L. J. Cohn	4/23/26		15	72,369.42		General Fund

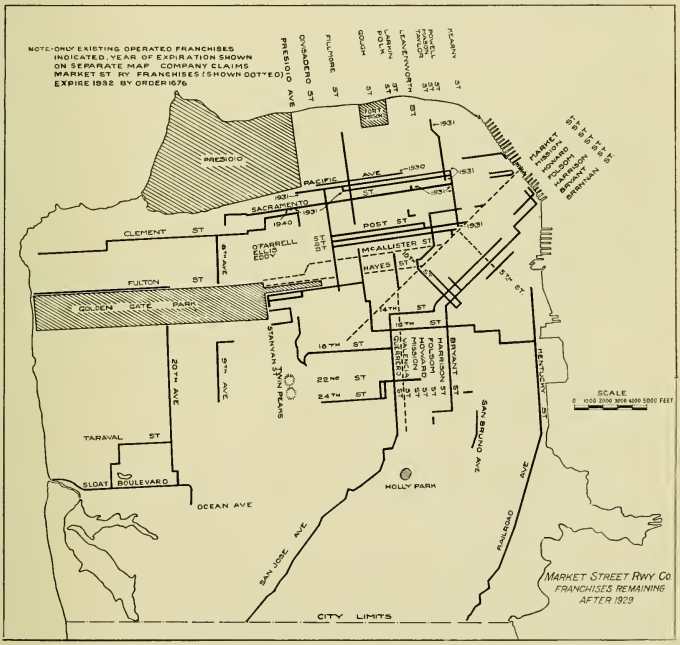
c Balance from Market Street Railway funds.

RAILWAYS

Market Street Railway Status:

In several previous annual reports as well as in other reports from this office, attention has been directed to the fact that a number of the franchises involving a large proportion of the trackage operated by the Market Street Railway within the City and County of San Francisco will expire in the year 1929. The mileage of single track involved is 115 miles or approximately 55 per cent of the company's San Francisco system. Some of the more important franchises expiring are for street railways operating on the following streets: O'Farrell, Sutter, Turk, McAllister, Hayes, Haight, Market, Valencia, Mission, Howard, Folsom, Lincoln Way, Masonic Avenue and Kearny. The franchises which do not expire by 1929 are shown on the map prepared by Bion J. Arnold in 1912.

In 1930 eleven more miles of line operated by the Market Street Rail-



MARKET STREET RAILWAY COMPANY'S FRANCHISES
Map showing franchises remaining after 1929

way will expire; and in 1931 ten more miles; in 1940 twenty-eight miles; in 1942 thirteen miles; in 1944 seven and eight-tenth miles, and in 1947, the last of their trackage amounting to .419 miles.

The map of the Market Street Railway franchises remaining in effect after 1929 shows very clearly that much of the remaining trackage will be entirely detached, making it impossible for the company to give service on these tracks unless some arrangement is made for operating over connecting tracks. For instance, the Clement Street line, together with the 8th Avenue branch, is entirely isolated. The line over 20th Avenue together with the Sloat Boulevard line does not connect with any operative line of the Company. The only way to reach the retail shopping district on Market Street from either Railroad Avenue or San Jose Avenue is via 16th Street, Fillmore Street, Oak Street, Divisadero Street, and either Eddy or Ellis Street. Similarly some of the lines for which the franchises will have expired will be isolated so that it will be impossible for the Municipal Railway to operate them without providing for proper connections with its systems, and even this in many instances will not make possible proper operating routes. The line on Lincoln Way could be operated through the Duboce Tunnel and down Market Street; also the Ocean Avenue line could be operated through the Twin Peaks Tunnel. Such lines as Mission Street, Howard Street and Folsom Street could be operated as a unit as the franchises expire for practically their entire length. The same would be true of the Kearny-Third Street line, but it would be impossible to operate from Kearny Street across Market down Third Street, continuing on Third Street across the Channel and out into the Bayview district, as the Market Street Railway will hold that portion of the line south of the Channel. The Sutter Street line might be operated from the Ferry out to Presidio Avenue but could not be continued beyond that point on its present route, as this portion of the line including Clement Street would still be in the possession of the Company.

These illustrations show how fragmentary would be the trackage of the City and the Company, resulting in neither being able to give satisfactory service. In order to provide satisfactory urban transportation, continuity is essential, either by the through routing of cars or by means of transfers.

The granting and extending of railway franchises are so hemmed in by restrictions of the State law that no private enterprise is likely to feel justified in borrowing capital for new extensions or extensive improvements of existing facilities.

A great deal of study and work has been spent on this problem already; even as far back as December, 1912, a charter amendment was submitted to the electorate which provided for a resettlement of the existing franchises. In 1921 the City Engineer prepared a complete valuation of the Market Street Company, and in 1925 an initiative measure providing for the purchase of the properties for 36 million dollars was defeated. At

other times committees of Supervisors have been appointed with a view to bringing the matter to a permanent and satisfactory termination, but no definite policy has been adopted.

The problem of working out a satisfactory plan of operation which would give the ultimate in service to the public is not one of tremendous difficulty from a physical point of view. It will, however, be difficult to reach a solution which will be satisfactory to the Municipal authorities, the Market Street Railway Company, the general public and the self-constituted critics and amateur experts. However, if the problem is approached with open minds and with an honest desire to solve it in the best interests of the public, there is no doubt that a satisfactory solution can be worked out. This, however, must be done within the next two years in advance of the franchise expirations; and as an initial step, I would recommend that a sufficient appropriation be made so that this office may make a proper study of the situation and prepare a report covering the several possible solutions of the problem in order that the Board of Supervisors and the public may have all of the necessary information before them to reach a sound decision in the matter. It is estimated that the sum of $50,000 should be made available for this purpose which would provide for the employment of any necessary experts in the matter.

Such a report would designate the lines of the company which will not be used or useful, what additional track should be constructed to make the most efficient system and the routing of the cars to give the best and most economical service on the unified lines. The report would indicate what results may be expected financially from the combined systems under Municipal control. The effect on traffic congestion would also be included as well as other matters necessary for consideration as a part of the problem as a whole. With such a report at hand the Board of Supervisors and the general public would be in position to intelligently determine a policy to be followed in all street railway matters.

California Street Railroad:

What has been said about the Market Street lines also applies to the California Street Cable Railway as franchise rights for all of their 11½ miles of track expire in 1929. In September, 1925, a resolution was passed by the Board of Supervisors asking for action on the acquisition of this road, but to date nothing has been done. The railroad has been kept in good condition and should be purchased by the City.

Extensions:

During the year an extension of the Municipal Railway was made into the Ocean View District and ten blocks of track were built on Judah Street between Thirty-first and Forty-first Avenues. Otherwise the development of new residence tracts and the building up of some of the older districts has proceeded without a corresponding growth in transportation facilities.

The time has come when the further expansion of several sections of the City will be seriously hampered by the lack of street car service. The financial status of the Municipal Railway will no longer permit of making extensions and additions from current earnings and in order to carry on this work a bond issue is necessary if not imperative at this time. Such an issue of bonds should provide not only for extensions to the trackage but also for additional cars, buses, housing and shop facilities, the latter items being necessary for the efficient operation of the present system. My recommendation of February 26, 1925, which was published in last year's report, covering such a bond issue in the sum of six million dollars has as yet received no action from the Board of Supervisors.

Ocean View Extension: This line, extending from a connection with the Twin Peaks Tunnel line tracks at St. Francis Circle, passes southerly for about 6,800 feet through the property of the Spring Valley Water Company, parallel to and 840 feet west of Junipero Serra Boulevard, to the intersection of this line with Worcester Avenue produced, thence turning easterly crosses the Junipero Serra Boulevard and running on Worcester Avenue, Randolph, Orizaba and Broad Streets, terminates at Plymouth Avenue. Service on this route, known as the "M" line, was commenced from St. Francis Circle to Plymouth Avenue on October 6th, 1925.

The receipts from this line average 76 cents per car hour, which approximately equals the amount paid to the motorman or conductor, and are sufficient to pay about one-fourth the actual costs. This office recommended against the premature construction of this line and tried to delay its building until such time as the territory adjacent to it could more nearly support railway service.

There has been some criticism of the locating of the track through the Spring Valley land, which is not yet subdivided. It must be remembered that the Spring Valley Water Company paid practically one-third of the cost of building the entire Twin Peaks tunnel and like other zones west of Twin Peaks were entitled to their ratio of transportation facilities which they did not ask the City for. There is no practical way to reach the Ocean View District from the Ingleside tracks of the Municipal Railway except on or parallel to and west of Junipero Serra Boulevard. A line on the boulevard was practically impossible as it would interfere with one of our heavily traveled narrow thoroughfares leading out of the City. Traffic along this route will increase rather than decrease and plans have been made to widen the road. Going west of the boulevard put the tracks in the Spring Valley Water Company's lands, which was agreeable to the people in Ocean View, which district paid its ratio of Twin Peaks tunnel cost. The Company donated the right of way for the railway provided that the line was so placed as not to interfere with their plans for subdivision. This consideration fixed the distance of 840 feet west of the boulevard, which will harmonize with the future plans, as this route will some day become part of the high-speed electric service

up Market Street, through the Twin Peaks Tunnel and south into San Mateo County. It is not as yet definite when this scheme will be carried out but it will be necessary at no greatly distant date.

Sunset Line: The settlement of the Duboce-Sunset Tunnel controversy has cleared the way for the construction of a direct line between the Sunset District and the business section of the city. The route adopted begins near Judah Street and Forty-eighth Ave., thence on Judah Street to Ninth Avenue, on Ninth Avenue to Irving Street, on Irving Street to Carl Street, on Carl Street to the west portal of the tunnel near Cole Street, through the tunnel to Duboce Avenue near Scott Street, and thence via Duboce Avenue to a connection with Market Street.

The preparation of detail drawings is under way, and it is proposed to begin construction in time to have the tracks laid when the tunnel is completed. There can be no operation unless additional cars are purchased.

The grading and paving of ten blocks on Judah Street between Thirty-first and Forty-first Avenues is now proceeding, and to avoid tearing up the new pavement within a short time, the tracks have already been constructed on this portion of the line. By doing the track work at this time it is estimated that a saving of $15,000 has been made.

Extension of Taraval Street Line: The proposed improvement of a considerable area in the vicinity of Sloat Boulevard and the Great Highway, following the construction of the Municipal swimming pool and playground has brought up the question of a Municipal Railway extension to serve the district. As in the case of the ten blocks on Judah Street above referred to, it is distinctly advisable to install the track work in advance of the pavement, and this office has under consideration an extension from the present Taraval Street line along Forty-sixth Avenue to Wawona Street, looping around the block bounded by Forty-sixth Avenue, Wawona Street, Forty-seventh Avenue and Vicente Street. The making of such an extension may assist in increasing the receipts of the Taraval Street line.

Bus Lines:

Monterey Boulevard Bus: This bus line, mentioned in last year's report, to serve St. Francis Wood, Westwood Park and vicinity, was put in operation December 5, 1925. For this service three Pierce-Arrow buses were presented to the City by the Residential Development Company, a real estate concern operating in this district, their offer to supply these buses having been accepted by the City by Ordinance No. 6724.

Opposition on the part of some of the residents of the route over which the buses were first operated, resulted in the enactment of an Ordinance (No. 7059) defining a new route with a terminus at Forest Hill Station. This route, which was adopted after public hearings and investigation on the ground, will serve a larger area and is in many re-

spects an improvement over that first proposed. Pending the completion of some street work, which is necessary to permit operation over the route, a temporary compromise route terminating at St. Francis Circle is being used.

Legion of Honor Bus Line: A bus line to the Legion of Honor Building in Lincoln Park, also mentioned in last year's report, was authorized by Resolution No. 24565 of the Board of Supervisors, and an experimental service on Saturdays and Sundays was installed. The patronage received did not justify this operation, and on May 1, 1926, it was discontinued.

Embarcadero Bus Line: This line, which would operate along the waterfront between the Southern Pacific Station at Third and Townsend Streets and the Golden Gate Ferry at the foot of Hyde Street, seemed, after many vicissitudes, to be started on its way with the enactment of Ordinance No. 6723, approved August 11, 1925. Action under this Ordinance was made contingent upon the execution of an agreement with the State Harbor Commissioners for a subsidy of not to exceed $18,000 per annum, but meanwhile this office started work on the project.

Careful study seemed to indicate that the most economical and efficient type of bus for the service would be a six-cylinder bus of 21 passengers capacity, taking care of peak loads with additional buses. Specifications in accordance with these ideas were transmitted to the Board of Public Works on November 25, 1925.

Ordinance No. 6926, authorizing the Mayor to enter into the agreement with the Harbor Commissioners was approved January 8, 1926, and the agreement itself, embodied in Resolution No. 25351 of the Board of Supervisors, was approved March 16, 1926. Thereupon the Board of Public Works advertised for bids, which were received on May 5, 1926. After consideration of all the proposals received, this office on May 12, 1926, recommended the purchase of six 21-passenger Yellow Coaches, at a total cost of $35,790.15. The Board of Public Works, however, formally awarded contracts for two four-cylinder, 29-passenger Mack buses, at $9,107.82 each and four similar Fageol buses at $8,400 each, a total of $51,815.64. This action of the Board has resulted in legal complications which for the time being have stopped further progress toward the establishment of the service.

Car Barns, Shops and Garage:

These subjects were covered in last year's report, and except that the need for these facilities becomes more urgent from day to day, the situation has remained unchanged. The shop now used for railway maintenance is the one originally provided for in building the Geary Street car barn when the City was operating 15 miles of road and 43 cars. With an increase in mileage to 70 and with cars to the number of 213 and 15 more to be constructed shortly, the shop facilities are so crowded as to prevent readily securing the most satisfactory and efficient work. Master Mechanic Wm. C. Bendel has taxed his ingenuity to nearly the

limit in order to do the work necessary to keep the cars in serviceable condition and is to be commended for the showing he has made under the conditions. The matter of adequate shop facilities must be given very early attention.

The increase in the number of buses, trucks, and other gasoline driven vehicles of the railway has given rise to a serious problem of housing and servicing. A separate garage and shop should be provided, and the space now used for these purposes released for the storage and care of railway cars.

Equipment:

The present equipment of cars is barely sufficient to maintain the normal rush hour service, and it is imperative that new cars be provided within the near future. Ordinance No. 7134, authorizing the purchase of fifteen new cars was finally passed on June 21, 1926, and already work has started on the preparation of the necessary plans and specifications.

HETCH HETCHY WATER SUPPLY

Progress and Development

The fiscal year July, 1925, to June, 1926, was marked by two events of major importance in the history of the Hetch Hetchy Water Supply:

The **Moccasin Power Development** commenced regular operation August 14, 1925, and under the distribution contract between the City and the Pacific Gas and Electric Company has been delivering electric power continuously since that date.

The gross revenue of the Moccasin plant alone for the 10½ months' operative period of the fiscal year was $1,993,965. The gross revenue from power generated by the system consisting of the Moccasin and Early Intake plants for the fiscal year was $2,047,225, and after deducting $240,365 for operating and other current expenses, and depreciation, the net amount available for the payment of interest and redemption of bonds was $1,806,860.

The **Bay Development** of the Hetch Hetchy Aqueduct, extending from Irvington to Crystal Springs Reservoir, was completed and was turned over as a whole to the Spring Valley Water Company for operation according to the agreement of 1922, on May 21, 1926. Sections of the aqueduct had been put in service eight months earlier at about 25 per cent of the capacity of the completed line, in conjunction with the Water Company's pipe line. The rental accruing to the City's credit for the use of the aqueduct during the fiscal year totaled $79,055, and will be at the rate of $250,00 per year for the present and succeeding years.

The construction forces having completed their labors on the two developments just mentioned, their attention has been turned to completing the 95-mile connecting link between Moccasin Creek and Irvington, which still remains to be built before Hetch Hetchy water can be made available to San Francisco.

In the **Foothill Division,** between Moccasin Power House and the San Joaquin Valley, final location surveys were completed, lands and rights of way were acquired, 25 miles of water supply pipe lines and 10.5 miles of electric transmission lines were constructed to serve all working points, four camps were completed and construction plants installed, two shafts were completed, and 2,835 linear feet of tunnels were excavated from four working points. At the end of the fiscal year two additional camps were under construction, and specifications for seven miles of tunnel work to be done under contract were in preparation. All work done during the year was on a day labor basis. The construction force was largely made up of men who had formerly worked on the Mountain Division tunnels.

In the **Coast Range Division,** final studies were made of the topography and geology of the region along and near the previously surveyed preliminary location of the aqueduct, and core borings to supplement these studies were made under contract. As a result of this work, the

general location of the preliminary line surveyed in 1916 was found satisfactory, with some minor changes, and it is hoped that the Board of Supervisors will not further delay making the necessary appropriations for commencement of construction work.

In the last previous annual report of this office (fiscal year 1924-25) attention was drawn to the necessity for vigorous prosecution of construction work, in the following language, which will bear repetition:

"The completion of the Mountain and Bay Developments leaves still to be built 95 miles of aqueduct from Moccasin Power House to Irvington, which will connect the two constructed sections of the aqueduct and make an unbroken line from Early Intake to Crystal Springs.

"This work can be completed in five years, provided adequate finances are made available and the construction work is not retarded by failure of the Supervisors to enact the proper ordinances authorizing finances and the construction program as required.

"With the rapidly increasing consumption of water in the City it is essential that the work be carried on continuously and as expeditiously as possible in order that the aqueduct be completed and Hetch Hetchy water brought in to augment the supply now available from local sources, which cannot safely be depended on to be sufficient for our needs for more than six years. Severe restrictions on the use of water would have been necessary last year, 1923-24, but for the early occurrence of heavy rains. It would be very shortsighted policy to court repetition of such a condition by neglecting to carry the aqueduct construction to completion without undue delay."

A budget of proposed expenditures in the total amount of $8,027,554, for the construction of the Foothill Division Tunnels and appurtenant structures ($6,525,000) and for preliminary work and shafts in the Coast Range Division ($1,502,554), was submitted to the Board of Public Works by the City Engineer, December 14, 1925, approved by the Board the same date and transmitted to the Board of Supervisors. On February 8, 1926, the Board of Supervisors adopted a resolution approving the section covering the Foothill Division work, but no action has yet been taken toward making available the necessary funds for commencing the Coast Range work.

In June, 1926, the final month of the fiscal year, which was the first month of full use of the Bay Development of the Hetch Hetchy Aqueduct the average daily consumption of water from Spring Valley sources was reported by the Water Company as 50,267,005 gallons, an increase of 5,682,202 gallons over the figure for June, 1925. Figures available at the time of writing this report show the average daily consumption for eleven months of 1926 as 46,469,777 gallons, which is 3,744,412 gallons over the corresponding figure for 1925. The total dependable yield of the Spring Valley system as now developed being about 60,000,000 gallons daily, and the ultimate economical development about 65,000,000, it is clear that the margin to cover further increase in demand will vanish in a very few years.

The Foothill Division tunnels will be ready for service in 1929. Two years' time will be sufficient for the construction of the San Joaquin Valley pipe line. The Coast Range tunnels might possibly be built in four years, but it is more prudent and more economical to allow a five-year construction period. The time necessary for the Coast Range work therefore determines the time of completion of the entire aqueduct, and unless this work is commenced in the very near future the City is likely to be on short rations of water before the aqueduct is in service.

Organization and Headquarters Work

The Hetch Hetchy Water Supply work is carried on under the general direction of M. M. O'Shaughnessy, City Engineer. Nelson A. Eckart, Chief Assistant Engineer, exercises direct supervision over all the work.

City Headquarters Office:

The City office staff lays out and designs all projected work, prepares plans and specifications, selects and purchases equipment for day labor work, prepares maps and descriptions of lands and rights of way, and checks and passes for payment all bills and payrolls. The staff personnel includes: R. P. McIntosh and L. W. Stocker, Civil Engineers; P. J. Ost, Electrical Engineer; E. P. Jones, Mechanical Engineer; Joseph J. Phillips, Right of Way Agent; H. W. Kephart, Purchasing Agent, and other employees.

A table of the important features of all Hetch Hetchy Water Supply contracts in force during the year is appended to this report. The list is continuous with sheets printed in the reports of preceding years. The work done under each contract is described later, under the appropriate division heading.

Field Headquarters:

The headquarters staffs supervising the work in the field remained organized substantially as in the previous year.

Headquarters for the Foothill Division were moved from Groveland to Hetch Hetchy Junction November 27, 1925. L. T. McAfee, Construction Engineer, has charge of the Foothill Division work. A number of items of work in the Mountain Division, not quite completed at the end of the previous fiscal year, were also carried out under Mr. McAfee's supervision.

The Bay Development work remained under the direction of C. R. Rankin, Construction Engineer, located at Palo Alto.

The Coast Range Division preliminary work was handled by J. H. Hampson, Assistant Engineer, located at Livermore, working under the direct supervision of the City office. M. J. Bartell assisted in the geological investigations.

Field Employees:

The number of employees in the field increased from 358 at the beginning of the fiscal year to 620 at the end of the year, due to the opening up of the Foothill Division work. The following table shows the

number of men employed on the various jobs on June 30, 1925, and June 30, 1926:

	June 30, 1925	June 30, 1926		
		Construction	Operation	Total
Lake Eleanor Reservoir	1	.....	1	1
O'Shaughnessy Dam	1	.....	3	3
Lower Cherry Power System	7	.....	19	19
Early Intake Diversion Works	.....	.....	2	2
Mountain Division Tunnels	.....	.....	2	2
Priest Reservoir	.....	.....	1	1
Moccasin Headworks	36	.....	2	2
Moccasin Penstocks	33	.....	....	.....
Moccasin Power House	78	.....	27	27
Moccasin Regulating Reservoir	.....	10	....	10
Moccasin-Newark transmission line	.....	.....	4	4
Hetch Hetchy Railroad	13	.....	....	.....
Foothill Division Tunnels	8	431	....	431
Coast Range Division, surveys and borings	.....	7	....	7
Bay Crossing pipe line	20	.....	....	.....
Dumbarton Strait bridge	46	17	....	17
Dumbarton Strait submarine pipe	38	17	....	17
General and miscellaneous	77	71	6	77
Totals	358	553	67	620

Groveland Hospital:

The City's hospital was not removed to Hetch Hetchy Junction with the construction headquarters organization, but continues in operation at Groveland.

Groveland, as a hospital location, though less convenient to the westerly part of the division than Hetch Hetchy Junction, is in other respects superior, having a more comfortable climate in summer and being quieter now that the Hetch Hetchy Railroad is no longer giving regular service.

The hospital is fully equipped and has a capacity of 75 patients. A physician (Dr. J. P. Degnan) and two trained nurses constitute the staff.

Cases treated at the hospital during the past fiscal year were as follows:

Non-hospital cases		362
Hospital cases:		
City employees	136	
Outside pay patients	75	211
Total cases treated		573
Capital operations		56

Average time in hospital for hospital cases, 19.85 days.

The physician in charge at the hospital visits all camps from Moccasin to Oakdale Portal at regular intervals, and makes special trips to the camps and other points when necessary.

Patients not connected with the City work are accepted at the hospital. A charge based on cost of service is made for the treatment of such patients.

Hetch Hetchy Junction Headquarters:

The completion of construction work east of Moccasin Creek and commencement of the Foothill Division tunnels left the town of Groveland several miles east of any active construction operations. Hetch Hetchy Junction was selected as Foothill Division headquarters. This is quite centrally located between the Moccasin Creek and Oakdale Portal, is on the line of the Sierra Railway most convenient for access to all the camps and for distribution of material, etc.

Quite a number of the buildings used at Groveland as headquarters buildings for the Mountain Division were knocked down and re-erected at the Junction. These included the office annex, warehouse and commissary buildings and some of the employees' cottages.

On November 27, 1925, the headquarters staff was moved to the new establishment, except for the hospital staff, which remains at Groveland.

Hetch Hetchy Railroad

As noted in last year's report, the Hetch Hetchy Railroad was withdrawn from service as a common carrier February 15, 1925, and discontinued steam service June 1, 1925.

The service on the railroad during the fiscal year 1925-26 was limited to that necessary to serve the Moccasin Power Plant and the construction camps at Pedro and Moccasin Creek. Gasoline motor cars are used for both freight and passenger service of that nature, except for the few unusually heavy loads that cannot be handled by the motor cars and are therefore hauled by a steam locomotive. The generator stators for the Moccasin Power Plant and the reel of 2¼-inch steel wire rope for the Red Mountain Bar cableway are examples of such heavy loads.

The Yosemite National Park authorities early in the fiscal year urgently requested the removal of the track and the resurfacing of the roadbed for the nine miles between Mather and O'Shaughnessy Dam, so as to make the dam accessible to automobiles. This was one of the City's obligations under the Raker Act, and the request was therefore complied with. In connection with this work steam service was commenced on the railroad September 1, 1925, and maintained until November 10th. When it becomes necessary to haul large quantities of freight for the future addition to the O'Shaughnessy Dam or for the construction of any of the other dams contemplated at Lake Eleanor and elsewhere, provision is made in the Supervisors' ordinance that the rails may be relaid to serve such construction work.

On June 30, 1926, the rolling stock of the Hetch Hetchy Railroad comprised the following items of equipment:

Steam locomotives 4

No. 3, Baldwin, 2-8-2, weight on drivers 131,000 lbs.

No. 4, American, 2-8-2, with superheater, weight on drivers, 144,000 lbs.

No. 5, American, 2-6-2, with superheater, weight on drivers, 100,000 lbs.

No. 6, Shay geared, with superheater, 12 driving wheels, average weight 202,000 lbs. (Sold July 12, 1926).

Passenger train cars 5

2 coaches, seating capacities 52 and 56.

1 combination coach and baggage car, seating capacity 42.

2 excursion cars (converted flat cars), seating capacity 77 each.

Freight and work train cars 39

8 ballast cars, V-bottom, capacity 80,000 lbs., or 30 cubic yards.

2 gondola cars, drop bottom.

10 flat cars, capacity 60,000 lbs.

1 flat car, capacity 80,000 lbs.

2 flat cars, capacity 100,000 lbs.

7 box cars, capacity 40,000 lbs.

1 box car, capacity 50,000 lbs.

4 box cars, capacity 60,000 lbs.

1 snow plow.

1 steam shovel.

2 cabooses.

Gasoline motor cars equipped to run on rails:

Passenger service—12, 23, 25 and 32 passengers 4

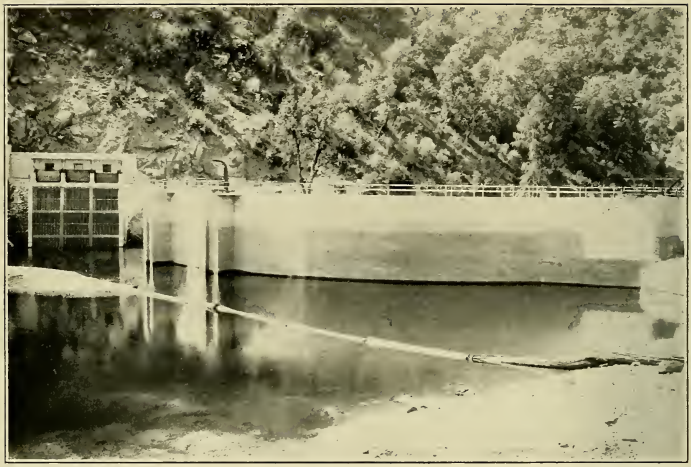
Freight service—2 tons each 2

Speeders 3

It is the intention to dispose of all of the railroad equipment as favorable opportunities present, retaining only one light locomotive and a few flat cars, and the gasoline track motor trucks. The need for any extended use of this class of equipment will not arise until some time in the distant future in connection with the future power development at Early Intake or the additional dam construction at Eleanor and Hetch Hetchy; the depreciation of this class of equipment and the expense of maintaining the same is such as to make it undesirable to hold these locomotives for such a period.

Aqueduct, Mountain Division

The Mountain Division of the Aqueduct, which embraces the Early Intake Diversion Dam and the aqueduct tunnel to Priest Reservoir, was completed and in service prior to July 1, 1925. The work of the past fiscal year in this division consisted principally of the removal of buildings and equipment from the camps. All buildings at Big Creek, Second Garrote, Priest Dam, West Portal and Cavagnaro camps were torn down and, so far as practicable, salvaged for re-use in the Foothill Division



View of upstream face. Here water from Hetch Hetchy Reservoir is turned from the Tuolumne River into the Mountain Division Aqueduct Tunnel. The structure at the left supports the screens and houses the headgates controlling the entrance of water into the aqueduct tunnel.

At the extreme right is the house over the aqueduct headgates. The water not taken into the aqueduct is shown overflowing through the spillway. The flume at the left conveys water from the Lower Cherry diversion.

EARLY INTAKE DIVERSION DAM, MOUNTAIN DIVISION, HETCH HETCHY WATER SUPPLY

camps. The construction equipment was transported to Hetch Hetchy Junction and Moccasin Creek, reconditioned, and either distributed to the Foothill Division camps for use in driving the tunnels between Moccasin Creek and Oakdale Portal, or placed in storage at the Junction for future use on either the Foothill or Coast Range Division.

Moccasin Division

Under this head are included Priest Reservoir, the Moccasin Power Tunnel through the ridge west of the reservoir, the steel penstock pipes, and the Moccasin Power House. Construction work on these units was completed during the fiscal year 1924-25, except for a few details not affecting the operation of the system. On the last day of that year (June 30, 1925), as described on page 87 of the report for 1924-25, breaks occurred at points of defective welds in the penstocks when the plant was practically ready to be put into regular operation. These breaks resulted in flooding the power house basement with mud and water, which entered the generator pits. Considerable time was required for repairing and retesting the penstocks, cleaning out the mud from the power house and its surroundings, and drying out the generators, so that it was not until August 14th that delivery of power was begun under the contract between the City and the Pacific Gas & Electric Company for distribution of power. The makers of the pipe have made adequate compensation to the City for liability due to defects.

Moccasin Power Development—Operation

This year witnessed the final completion and placing in continuous commercial service of one of the most profitable units of the Hetch Hetchy Development, the Moccasin Power Plant.

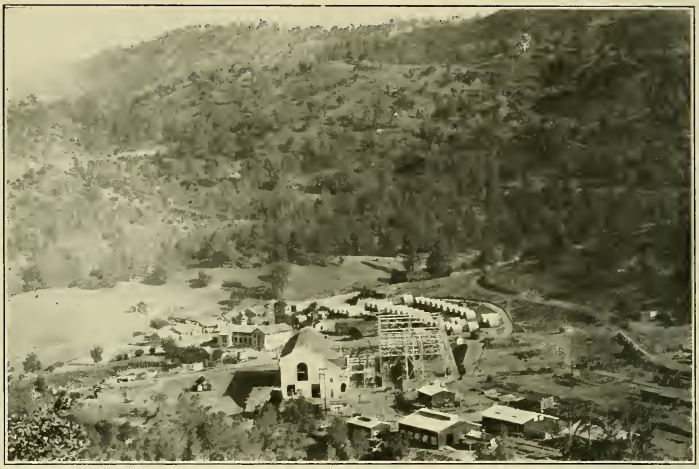
On August 14, 1925, at 4:49 P. M., Generator No. 3 was connected to the transmission line and commenced delivering electric energy to San Francisco through the Newark Station of the Pacific Gas & Electric Company.

Unit No. 2 was tuned up on the next day and placed in service in parallel with Unit No. 3.

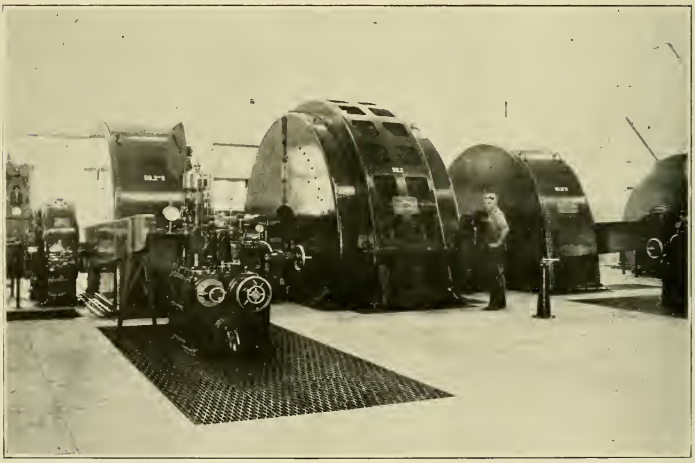
Considerable difficulty was experienced in drying out the fields of the No. 1 and No. 4 Units, so that these were not ready for service until August 20, 1925, when No. 4 was placed in commission at 12:44 P. M. and No. 1 at 4:27 P. M.

In accordance with the contract with the Pacific Gas & Electric Company, energy from the Moccasin Plant is transmitted over the City's high tension tower line from Moccasin to the Pacific Gas & Electric Company's Newark substation on San Francisco Bay, a distance of 98.6 miles. At this point, a connection is made through proper switching and metering apparatus with the transmission system of the Pacific Gas & Electric Company and is delivered in San Francisco over the Company's lines and through the local distribution system reaches the consumers in San Francisco.

As given in detail in last year's report, the contract requires the Pa-



General view—To the left of the power house is the clubhouse, then the permanent cottages, and on the hill behind the cottages, the schoolhouse. The steel bus structure is at the right of the power house.



Interior of Power House showing one of the generating units. In the center, a 20,000 KV-A alternating current generator driven by a water wheel on each side; at the left, a direct-driven exciter, and in the foreground a governor.

MOCCASIN POWER PLANT, HETCH HETCHY WATER SUPPLY

cific Gas and Electric Company to account to the City for this energy as distributed to the inhabitants of the City. During the year from August 14th, 1925, to June 30, 1926, this accounting was as follows:

Output and Revenue Statement, Moccasin Power Development
August 14, 1925, to June 30, 1926 (10½ months)

Power Summary	Kilowatt-hrs.
Total energy generated	441,223,500
Power Distribution	
Used on Hetch Hetchy Water Supply	1,802,775
Delivered to Transmission Lines	439,420,725
Transmission Losses	30,665,775
Delivered to Pacific Gas & Electric Co. at Newark Substation	408,754,950
Losses between Newark Substation and San Francisco consumers' meters, 24 per cent	98,101,188
Delivered to San Francisco consumers	310,653,762
Revenue	
Total revenue from San Francisco consumers at average rate of 2.383 cents per kilowatt-hour	$7,402,879.15
Company's compensation, 73.065 per cent	5,408,913.65
City's revenue	$1,993,965.50

It will be noted that for the period of operation, which was less than 10½ months, the City's gross revenue amounted to $1,993,965.50, almost $2,000,000. In negotiations preceding the contract it had been estimated that the maximum revenue likely to be received through the operation of the plant would be $2,000,000 for a twelve month period.

The Moccasin Power Development has demonstrated that in normal water years it can deliver energy in excess of the original estimates. The plant was designed for a continuous load of 52,500 k.w., but is actually capable of carrying a continuous load of almost 60,000 k.w. This increased capacity is due in large part to the fact that the aqueduct has an excess capacity of approximately 17 per cent, as a result of a slight increase of entrance head and a lesser coefficient of roughness than originally calculated. Also owing to a favorable power factor the transmission line from Moccasin to Newark is carrying power with a loss of approximately 7 per cent rather than 8 per cent, for which it was designed.

Early in October, 1925, tests were made by the salt velocity method developed by Professor C. M. Allen of Worcester Polytechnic Institute of Massachusetts, to determine the efficiency of the water wheels. These tests indicated that the water wheels were somewhat below the guaranteed efficiency and the Pelton Water Wheel Company has since that time been developing data which will permit them to make the necessary modifications to meet their guarantee. This work has involved research and experiment work with actual water wheel models, requiring a considerable length of time.

The electric generators were bought under a guarantee that with an air temperature of 104° F. they would deliver their full rated output without exceeding a safe temperature. During the hot part of the Fall it was found that the temperatures of the machines exceeded the safe limit. This matter was taken up with the General Electric Company, the manufacturers, who immediately took steps to study the machines while in operation and for this purpose detailed a specialist from their factory. His report resulted in the Company unhesitatingly agreeing to rewind the generators at their own expense. This work commenced with the rewinding of Unit No. 1 between April 19th and 25th, 1926. While the General Electric Company was ready to rewind the second unit in May, it was decided not to commence the work until after the heavy runoff from the melting snow had taken place and the reservoirs were being drawn on for power generation, thus utilizing to the fullest advantage the season's water yield.

Until the Moccasin Plant was put into service it had been necessary to maintain a standby connection with the Pacific Gas & Electric Company. This line, which was built in 1922, was constructed from a connection with a line serving the Modesto-Turlock Districts at Don Pedro and delivered power to Moccasin at 60,000 volts. When the Moccasin power house was placed in commission this was disconnected as a power line and was used as a telephone connection from Moccasin to Don Pedro, where a connection was made to the Pacific Gas & Electric dispatching line running to the Don Pedro plant. Thus direct telephone communication was secured with the Pacific Gas & Electric Company's dispatcher.

This 60,000 volt line when built by the City was intended to later form a part of the transmission line supplying power to the Foothill Division of the aqueduct construction work, so as soon as this construction power was required, the telephone connection was disconnected, and the line was used to transmit 22,000 volt energy from Moccasin Power House to Pedro siding on the Hetch Hetchy Railway where it connected with a new piece of 22,000 volt line built along the aqueduct route, a distance of 11 miles, to Oakdale Portal. Since then the Moccasin plant dispatching has been carried on over the toll lines of the Pacific Telephone & Telegraph Company.

Plans contemplate the use of a carrier current system of communication using the high tension transmission wires from Moccasin to Newark, thence via the Pacific Gas & Electric Company's private line to the dispatcher. The power company is making a thorough investigation and trying out several carrier current systems, but has not as yet reached a conclusion as to the one most satisfactory. The City system will temporarily work in conjunction with the Company's system, and we will therefore get the benefit of their experience before making our own installation.

The Moccasin system has a most enviable record of operation. This

is due in no small degree to the operating personnel which has been selected with a view to securing only the most competent and experienced men. The regular operating force at Moccasin, under the Assistant Electrical Engineer in charge of operation, consists of a Chief Operator, 4 first operators, 3 second operators, 4 floor men, 3 governor men, 1 electrician, 1 mechanic, 2 helpers, and during the past year it has been necessary to keep on four additional men, catching up minor details of construction, consisting of a carpenter, painter and two men doing miscellaneous work.

At Lake Eleanor one gate tender is maintained; at O'Shaughnessy Dam, one dam tender and assistant. At Early Intake, where the Early Intake plant is still operated, there are stationed a chief operator, 3 operators, 2 ditch tenders, and a gate man. At the Priest Reservoir and Moccasin head works there is kept a gate man and an assistant. Along the transmission line, at both Livermore and Riverbank, a patrolman and a helper are on duty. In addition to the employees mentioned there are those necessary in connection with the Moccasin Club House, clerks, and others with duties of a general nature.

Lower Cherry Power Development

During the year the Early Intake power house, which was originally built to furnish construction power only, was continued in operation. The water used to run the Early Intake plant comes from Lake Eleanor and Cherry River, which joins the Tuolumne River 12 miles below the O'Shaughnessy Dam. For a considerable portion of the year the natural stream flow in Cherry River is sufficient to operate the Early Intake power house, and likewise at this same season the natural flow of the Tuolumne is usually such as to carry the Moccasin Plant. During the period of low stream flow Lake Eleanor and Hetch Hetchy Reservoirs are called upon to deliver water above the Early Intake Diversion Dam for use through Moccasin Power House.

In order to be able to dispose of the power that may be generated by the Intake plant from the Cherry River flow in the flood period, it is necessary to deliver a small amount of power throughout the dry season sufficient to regulate the voltage on the outer end of the Pacific Gas & Electric Company's circuit to which we are connected. This requires approximately 25 cubic feet per second.

All the water available from the Cherry flow and Eleanor storage which may be beneficially used to supplement the Tuolumne flow and the release from Hetch Hetchy Reservoir is dropped above the Intake Diversion dam and used in the Moccasin Power Plant under an effective head of 1,300 feet as against 350 feet at Early Intake, with the exception of the 25 cubic feet before mentioned, if after making up any of the water requirements of Moccasin any surplus is available it is passed through the Intake plant and utilized to the capacity of this plant.

Output and Revenue Statement, Lower Cherry Development
July 1, 1925, to June 30, 1926

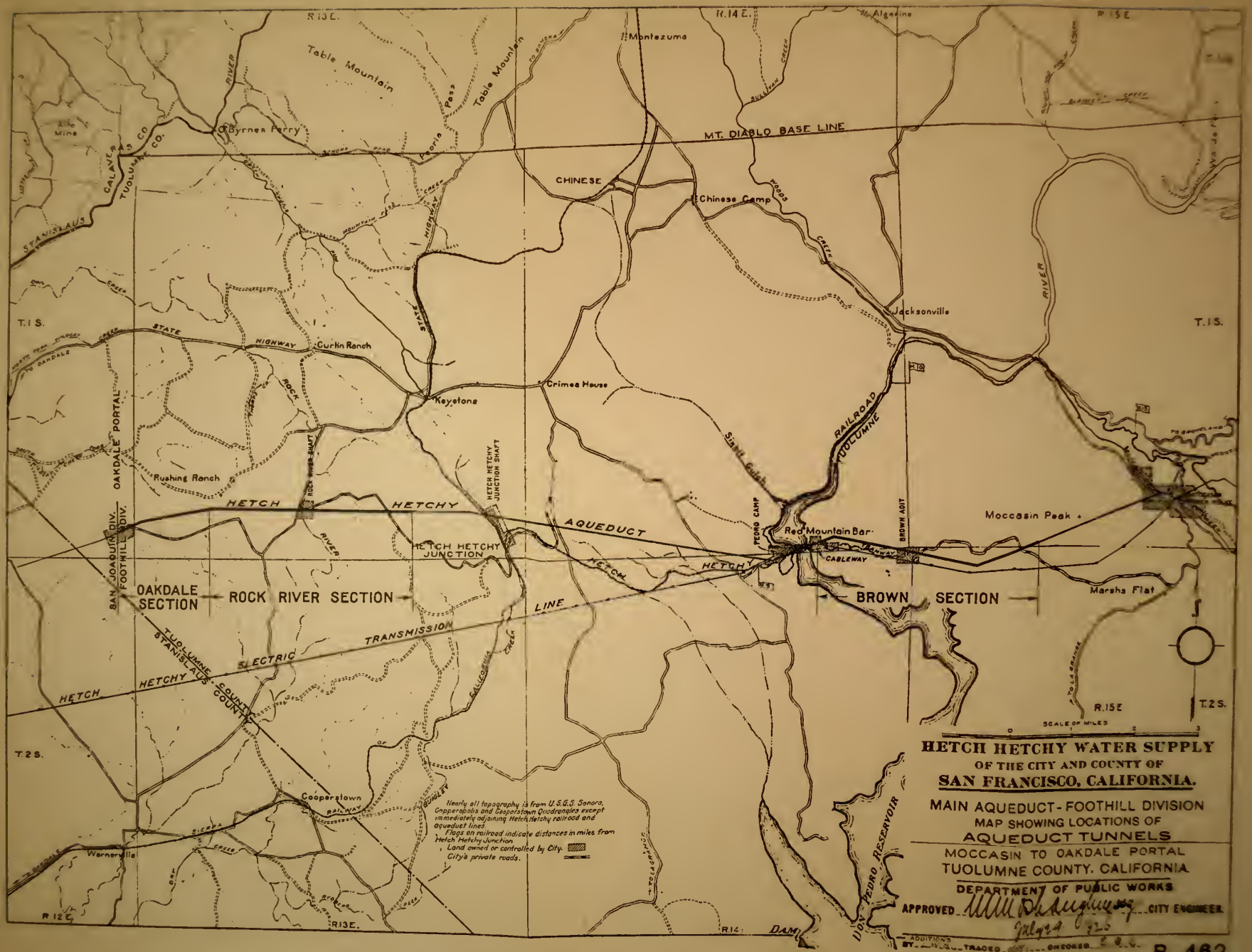
Power Summary	Kilowatt-hrs.
Generated at Early Intake Power House	16,293,900
Received from Pacific Gas & Elec. Co.	5,000
Total	16,298,900
Power Distribution	
Transmission losses	4,201,158
Used on Hetch Hetchy Water Supply	275,742
Delivered to Tuolumne Circuit of the Pacific Gas & Electric Co.	11,822,000
Total	16,298,900
Revenue	
Revenue from Pacific Gas & Electric Co., 11,822,000 k. w. h. at .5 cent	$59,110.00
Payment to Pacific Gas & Electric Co. for 5,000 k.w.h at .5 cent	25.00
Net Revenue from Sale of Power	$59,085.00

During the year, a number of the remaining construction substations on the mountain division have been removed or in some cases reduced in capacity to meet the operating requirements. The substations still in service are those at O'Shaughnessy Dam, Mather, Intake Siding, Second Garrotte, Groveland and Priest Reservoir.

It has also been necessary to do some maintenance work as the Early Intake system has now been in continuous operation for 8 years. This work included a thorough overhauling of the equipment in the power house and the reinforcement of a considerable number of the wooden poles along the transmission line. Until the North Mountain power house is constructed it will be necessary to bring the Lake Eleanor water down the Cherry River and through the Lower Cherry Aqueduct, in order to make it available for use through the Moccasin plant. This necessitates the maintenance of the Lower Cherry River Aqueduct. Some economy in water use could be made by moving the Early Intake power house to a point above the diversion dam. While this would reduce the head available for the Intake plant, it would make it possible to utilize all of the water diverted from the Lake Eleanor watershed through both the Intake and the Moccasin Creek Power Houses.

Following the abandonment of railway tracks between Mather and Damsite, the Yosemite National Park authorities requested that they be allowed to use the copper telephone circuit between these two points, formerly used as a railway dispatching line. This permission was granted with the provision that the City may switch over to this circuit in case of trouble on the other line or at any time it is found necessary to have the circuit for City business.


T. 1 S.
T. 2 S.
R. 12



HETCH HETCHY WATER SUPPLY
OF THE CITY AND COUNTY OF
SAN FRANCISCO, CALIFORNIA.

MAIN AQUEDUCT - FOOTHILL DIVISION
MAP SHOWING LOCATIONS OF
AQUEDUCT TUNNELS
MOCCASIN TO OAKDALE PORTAL
TUOLUMNE COUNTY, CALIFORNIA

DEPARTMENT OF PUBLIC WORKS
APPROVED _____ CITY ENGINEER
July 24 1925

ADDITIONS BY _____ TRACED _____ CHECKED _____
SCALE 1" = 1 mi. DATE _____
Base Map B-30 with additions

B-462

The two detailed statements of revenue from Moccasin and Early Intake plants show a gross revenue of $2,053,050.50 for the fiscal year, during which time the Moccasin plant was only in full operation for the 10½ months from August 20th on.

Aqueduct, Foothill Division

During the fiscal year the greater part of the preliminary work at the various working points in the Foothill Division was accomplished, camps and shafts were constructed and plant and equipment installed, and actual tunneling operations commenced at four camps. So far as practicable, the buildings and equipment used during the construction of the Mountain and Moccasin Divisions are being utilized on the Foothill Division work.

Location Studies and Surveys:

In 1915 a preliminary survey for the location of the Foothill Division was run, and in the following year topographic surveys and geological studies were made, using the 1915 survey as a base line and covering a belt of ground averaging one mile in width. Also, in 1916 a preliminary survey for the San Joaquin pipe line was made, extending westerly from the tentative location of Oakdale Portal, the easterly end of the Foothill Division.

In 1924 and 1925 final location studies were made in the City office to determine the best location for the Foothill Division tunnels and the easterly portion of the San Joaquin pipe line, which necessarily affected the location of the Oakdale Portal. The location finally adopted, along which the work is now being carried out, gives an aqueduct line about one-half mile shorter between Moccasin Creek and Oakdale Portal than the preliminary surveys, the total length of tunnel being now slightly under sixteen miles, with practically no change in the length of the easterly section of the San Joaquin pipe line.

Surveys were made during the course of the location studies in order to furnish additional information at critical points. On completion of the paper location, the entire aqueduct tunnel line from Moccasin Creek to Oakdale Portal was relocated on the ground with extreme care, and adit and shaft sites were definitely established. Profile levels were run over the line and precise levels were carried between the various working points. Topographic surveys of the camp sites were made, and also a number of surveys for roads, telephone lines, transmission lines, water supply lines for construction purposes, and tramways.

Right of Way Acquisition:

As soon as the surveys had progressed far enough to permit it, definite descriptions of the rights of way for the tunnel and all auxiliary construction features were prepared in the City Engineer's office and the necessary rights of way and lands were purchased. A sub-surface easement was taken for the tunnel. Surface easements were acquired for the roads and electric lines and water supply lines. All camp sites were

acquired in fee. A considerable part of the right of way between Moccasin Creek and the Tuolumne River had already been obtained from the Government under provisions of the Raker Act, but as the alignment was changed, it now became necessary to amend the right of way thus obtained. Very little of the privately owned land along the line of this division is cultivated, most of it being pasturage only, and the land is held in large parcels by a small number of owners, so that right of way acquisition was comparatively easy and entailed no great expense.

Water Supply for Construction Purposes:

As the springs along the line of the Foothill Division are insufficient to furnish camp water supply, a water system to bring water from Priest Reservoir to each of the camps was constructed. A considerable length of pipe would have been eliminated by taking water from the Tuolumne River near Red Mountain Bar, but this would have involved purification and continuous pumping, while the head from Priest Reservoir is ample to distribute the pure water by gravity to all camps. The gravity system was found on careful study to be the most economical when figured over the construction period and was therefore adopted.

For this purpose connection was made west of the surge shaft to the southerly butterfly valve at the west portal of the Moccasin power tunnel. Five-inch pipe was laid from that point to the Hetch Hetchy Railroad grade, and then along the railroad to a point near Pedro Camp. At this point connection was made to tanks to supply the Pedro Camp, and a branch line leads from Pedro Camp to Brown Adit. Continuing westerly from Pedro Camp, 4-inch pipe was laid along the railroad to Hetch Hetchy Junction, then over the tunnel right of way to Rock River and Oakdale Portal camps. The branch line serving Brown Adit uses 2,000 feet of 2½-inch pipe and 10,000 feet of 2-inch pipe. To cross Don Pedro Reservoir, it is suspended from a 1-inch cable, and thence it follows the general location of the tunnel line to the camp. The sizes and lengths of pipe installed in the Foothill Water Supply System, not including the camp distributing systems, are as follows:

5-inch pipe	59,170 feet
4-inch pipe	59,600 feet
2½-inch pipe	2,000 feet
2-inch pipe	10,000 feet
Total	130,770 feet
	or nearly 25 miles.

The 5-inch, 2½-inch and 2-inch pipe was purchased under contract No. 109. The 4-inch pipe was that salvaged from the Mountain Division.

Roads:

A considerable amount of road work was necessary to give access to the various working points in the Foothill Division.

At Moccasin Creek, the old county road on the left bank of the creek

passes through the site of the reregulating reservoir between the power plant and the Foothill Tunnel headworks. A new road, 1.3 miles in length, has been constructed to replace this section of the county road, the new road being located a few feet above high water elevation along the west margin of the proposed reservoir. Construction of the new road involved the excavation of 12,000 cubic yards of earth and rock, and was done very economically with the Model 36 Marion steam shovel formerly used on the Priest Dam construction. Surfacing of this road is now under way, and on completion and acceptance by the County Engineer the present county road will be closed to public traffic.

The existing road from Moccasin Creek to Marsh's Flat and the farm road from that point to Brown Adit were put in shape for hauling equipment and supplies for camp construction and for commencement of tunnel work pending completion of the Red Mountain Bar cableway.

At Pedro a new road, 1.3 miles in length, was constructed from the Don Pedro county road to the camp site and continued to the Hetch Hetchy Railroad and the west terminal of the cableway hereafter mentioned.

From Hetch Hetchy Junction to Rock River a new road 4.4 miles in length was constructed, following generally along the tunnel right of way, to make a convenient connection to the Rock River Camp. The latter camp is located beside a county road, but the distance from Hetch Hetchy Junction to Rock River Camp over the existing county roads was about nine miles, or more than double the distance across country, and the new road was necessary for economical hauling.

Oakdale Portal Camp is not located on or near any county road. Westerly from Rock River, a farm road one-half mile in length was improved and a new road 3.2 miles in length was constructed leading to Oakdale Portal. These roads will require surfacing before the winter rains.

Brown Adit Camp cannot be reached by road except by way of Moccasin Creek, and the summit of the road between Moccasin Creek and the adit is at an elevation of nearly 2,000 feet, while the adit itself is at elevation 849. In order to eliminate the greater part of this wagon road haul, and to avoid the necessity for climbing about 1,100 feet from Moccasin Creek to the summit and dropping down the same vertical distance, it was decided that a cableway should be installed spanning the Tuolumne River at Red Mountain Bar, and a light railway or tramway constructed from the east end of this cableway to the adit. This cableway is to have a capacity of five tons, the span between towers will be 2,295 feet, and the main cable 2¼ inches in diameter. This cable has been purchased from the E. H. Edwards Company, under Contract No. 112. It was manufactured at the contractor's mill at South San Francisco. It is of the "Improved Plow Steel" grade, having a breaking strength estimated at not less than 210 tons. Lidgerwood cableway equipment is being used. It is expected that the cableway will be in operation late in the summer of 1926.

The roadbed for the light railway has been graded and rails are now being laid. The railway is 8,525 feet in length and the track gauge is 24 inches.

Power Transmission and Telephone Lines:

The 22,000 volt transmission line extending from Moccasin Creek to Pedro Station, constructed during the summer of 1922 to give standby service for the Mountain Division, was extended along the Hetch Hetchy Railroad right of way to Hetch Hetchy Junction, and thence along the tunnel right of way to Oakdale Portal in order to distribute power for operating and construction purposes to all of the camps. The length of new line is approximately 10.5 miles. Substations for supplying power for construction purposes at proper voltage have been installed at Brown Adit, Red Mountain Bar, Pedro, Hetch Hetchy Junction and Rock River, and a substation will likewise be erected at Oakdale Portal.

Telephone lines also were constructed, connected with all camps, and a switchboard was installed at the Hetch Hetchy Junction office. A complete metallic circuit has been run from Moccasin Power House to Oakdale Portal.

Hetch Hetchy Junction Establishment:

As mentioned above, Hetch Hetchy Junction is now the division headquarters camp. Shops have been established here, using to a large extent equipment brought from the former shops at Groveland. These include machine shop, woodworking shop, and a repair shop for trucks and other motor cars. There is also a central warehouse and storage yard, in which equipment and supplies for both construction and camp purposes are stored until distributed to the various working points.

Many of the buildings for the various camps are of a portable knock-down type, the panels for which were gotten out at Hetch Hetchy Junction. The shops at the Junction will handle practically all repairs to equipment which cannot be taken care of at the various shafts, portals, or adits.

Tunnel Operations:

Tunnel excavation has been commenced at four camps and camp construction is under way at two others. Following is a brief description of the work done up to the end of the fiscal year at each camp:

Moccasin Portal: A camp is being constructed and excavation is in progress for foundation for compressors, blowers, etc.

Test pits, to determine the depth to bedrock and nature of the bedrock, were sunk along the axis of the proposed dam.

Brown Adit: A camp accommodating 120 men has been established and all equipment installed for tunnel operations.

An open cut 90 feet in length and an adit of standard tunnel section 127 feet long have been completed and driving started west on the aqueduct tunnel. The adit was faced on June 10th and completed on June 24th.

To June 30th a progress of 27 feet east and 49 feet west has been made on the aqueduct in a formation of hard schist.

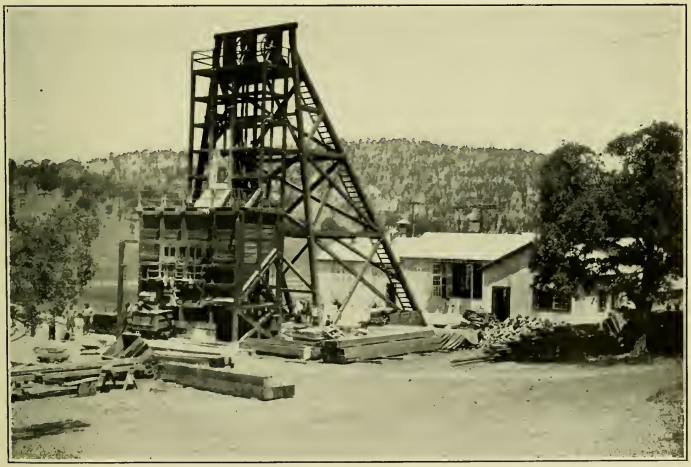
Pedro: A camp with capacity of 95 men was started on October 8th and completed, including installation of equipment for tunnel driving operations, on January 8, 1926.

A short open cut was constructed, and the west portal was faced on February 4th. Three shifts were put on early in March and good progress maintained in a formation of schist, which at times required timbering. A total of 1,680 feet has been driven in this heading, to June 30th.

The east portal was faced on February 10th and, working but one shift, a progress of 541 feet has been made in a formation of decomposed granite and granite boulders requiring timbering to the face.

Hetch Hetchy Junction: A camp accommodating 120 men has been constructed at this point and the usual plant installed for shaft sinking and driving two headings. Actual sinking began on March 15th and, working three shifts in a formation of black laminated slate standing vertically, the shaft was completed and drifting started east and west on June 3rd. The total depth of shaft from the collar to the bottom of the sump is 228 feet.

To June 30th, a progress of 177 feet east and 267 feet west has



ROCK RIVER SHAFT, HETCH HETCHY AQUEDUCT, FOOTHILL DIVISION

Headframe, bunkers and plant building. The shaft gives access to the aqueduct tunnel, which is here 120 feet underground.

been made in the same slate formation, which at times requires timber support.

Only three shifts are engaged, alternating in the two headings.

Rock River: A camp with a capacity of 120 men has been constructed and the necessary plant installed for sinking the shaft and driving tunnel.

Sinking began on April 15th and, working three shifts in a formation of hard schist, the shaft was completed on June 26th and drifting started east and west. The total depth of shaft from the collar to the bottom of the sump is 157 feet.

To June 30th, 42 feet east and 52 feet west have been driven on the aqueduct.

Oakdale Portal: A camp accommodating 90 men has been completed and the usual plant for excavating a single heading is now being installed.

Work on the open cut approach to the tunnel will begin at an early date.

Summary of Tunnel Progress:

The following table shows the progress in excavation of tunnels and shafts for the fiscal year 1925-1926:

Hetch Hetchy Aqueduct, Foothill Division—Progress
Total to June 30, 1926

Tunnel Excavation

Moccasin Portal: Camp under construction.	
Brown Adit—East	27 feet
Brown Adit—West	49 feet
Pedro—East	1,680 feet
Pedro—West	541 feet
Hetch Hetchy Junction—East	177 feet
Hetch Hetchy Junction—West	267 feet
Rock River—East	42 feet
Rock River—West	52 feet
Oakdale Portal: Camp completed, equipment being installed.	
Total tunnel excavation	2,835 feet

Shafts, Adit and Open Cut Excavations

Hetch Hetchy Junction Shaft, depth	228 feet
Rock River Shaft, depth	157 feet
Brown Adit, open cut 90 feet, adit 127 feet, total	217 feet
Pedro Open Cut	100 feet

Tunnel Design:

The Foothill Division tunnels will be partly lined and partly unlined, according to the nature of the rock encountered in the various sections. The standard cross-sections used in the Mountain Division will be used here also, except that ordinarily vertical side walls will be used below

the spring line in lined tunnel (standard tunnel sections No. 2) instead of the curved sides formerly used. The old horseshoe section (No. 1) or a circular section will be used where required to resist heavy lateral or upward external pressure. Unlined tunnels will be 14 ft. 3 in. in height and 13 ft. 4 in. in width within neat lines (standard section No. 5). Lined tunnels will be 10 ft. 3 in. in both height and width, inside of concrete lining.

Coast Range Division

The work of the fiscal year in the Coast Range Division was all in connection with the determination of the best location for the aqueduct in that division. Surveys and core borings at shaft sites and other points were made to supplement the information already on hand, and location studies based on all available information and on economic considerations were made in the office. The scope and conclusions of this work are indicated in the report reproduced below. Nearly all of the work mentioned was completed by the end of the fiscal year 1925-26.

Hetch Hetchy Aqueduct—Coast Range Division
Report on Adopted Final Location of Aqueduct
With Notes on Core Borings Along Aqueduct Line

October 4, 1926.

The Honorable,
The Board of Public Works of the
City and County of San Francisco.
Gentlemen:

Following is a report on the location which I deem most suitable for final adoption for the Hetch Hetchy Aqueduct through the Coast Range. This location has been determined in the light of surveys in considerable detail, and consideration of core borings made during the present year.

General Description of Coast Range Location: The aqueduct through the Coast Range will consist of tunnels in two sections, one extending from Tesla Portal at the west margin of the San Joaquin Valley to Alameda Creek, a distance of 25.2 miles, and the other section from Alameda Creek to Irvington Portal, 3.4 miles. These two sections will be connected by a steel pipe siphon across Alameda Creek Valley, about 2,850 feet in length. This gives a total length of 28.6 miles of tunnels, and a total length of the Coast Range aqueduct of 29.1 miles.

Tesla Portal is the designation given to the point at which the pipe line crossing the San Joaquin Valley will meet the Coast Range Tunnel. It is located at the base of the foothills, seven miles south of the town of Tracy. The tunnel line extends in a general westerly and southwesterly direction from this portal, passing seven miles south of Livermore and Pleasanton. The terminal point at Irvington Portal is located about one and one-half miles northeast of Irvington. A gatehouse will be constructed at or near the Irvington Portal. The attached map C-752 shows the location and profile of the aqueduct along the line now recommended. This map shows also the five proposed shafts and the core borings which have been made along and near the proposed line.

This location follows, in a general way, the route selected by Mr. John R. Freeman during his engagement as Consulting Engineer for the City of San Francisco in 1912, which is mapped and described in his re-

port "The Hetch Hetchy Water Supply of San Francisco, 1912." In locating the aqueduct tunnel, Mr. Freeman had the advice of Dr. J. C. Branner, a very eminent geologist (now deceased), who for many years was head of the Geological Department and for some time Acting President of Stanford University. Dr. Branner was thoroughly familiar with the geology of the Coast Range district, a considerable area both sides of the tunnel line having been studied and mapped under his direction. His detailed investigations were of great assistance to Mr. Freeman and later to me in my own investigations. Dr. Branner's report to Mr. Freeman indicated that the route selected was entirely feasible and practicable. The more detailed surveys and studies made under my direction since that time have confirmed the judgment of Dr. Branner and the feasibility of the tunnel construction on this location.

Survey of 1916: The alignment of the aqueduct as located by Mr. Freeman in 1912 was not actually surveyed by him at that time, but was merely drawn on the best available maps, including those of the U. S. Geological Survey. In 1916, under my direction, a survey was run through the Coast Range as a part of the general survey of the entire aqueduct line from Oakdale to San Francisco. The survey followed fairly closely the line mapped by Mr. Freeman, with some modifications suggested by the detailed geological study which was carried on just in advance of the survey. This line was carefully staked and monumented, and has served as the base line for the final location, parts of it being actually adopted without alteration as the final location.

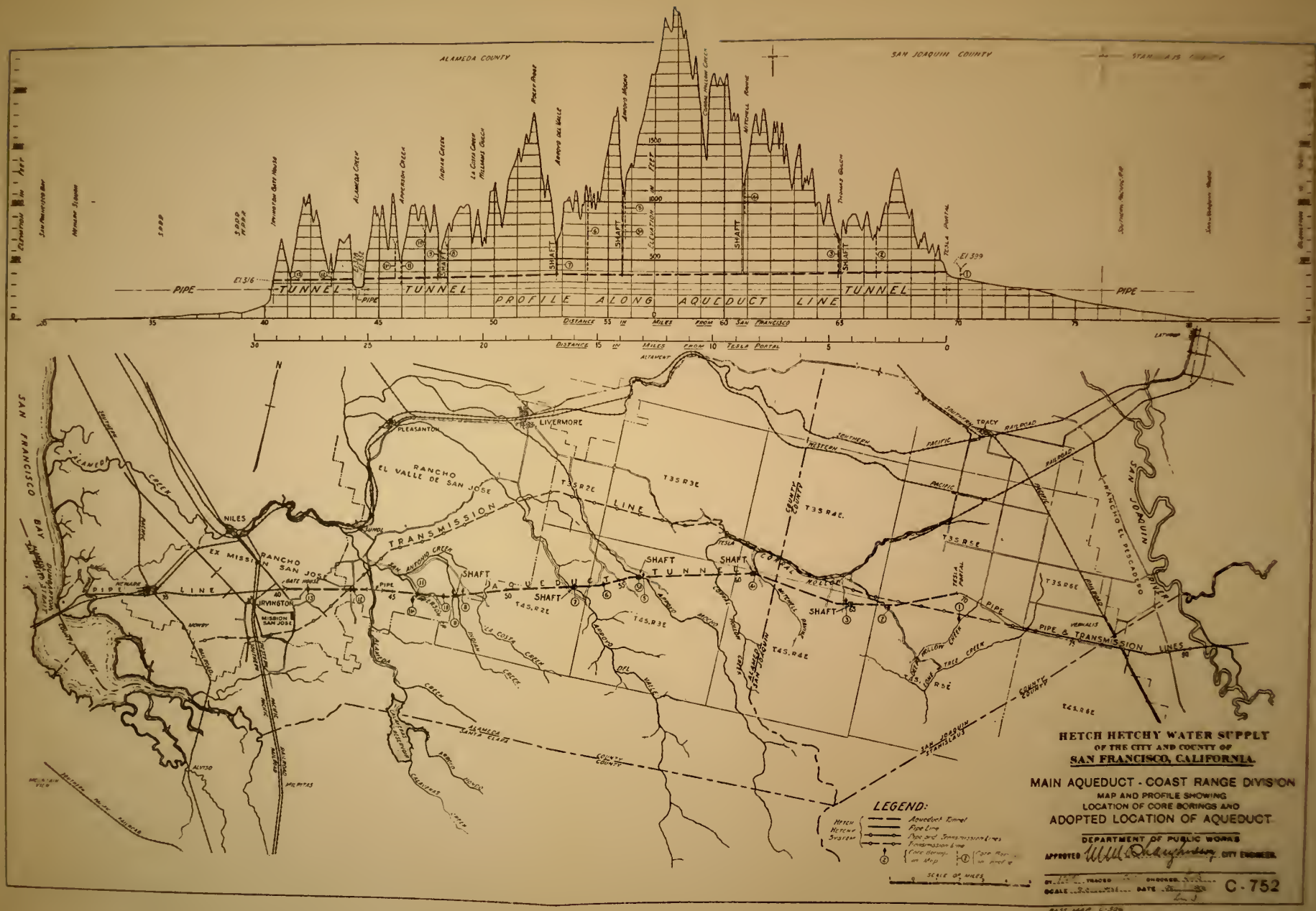
Considerations Governing Location: The aqueduct location is an unusually close approximation to a straight line connecting Tesla and Irvington portals, and is only about one-fourth mile longer than such a straight line . The deviations from the direct line are dictated partly by geological considerations and partly by the necessity for locating shafts of depths which are not excessive, at convenient points along the tunnel.

Five Shafts Required: Between Tesla Portal and Alameda Creek, five shafts are necessary. With two headings driven from each shaft and one from each of the four portals (Tesla, Alameda Creek east and west, and Irvington), tunneling can be carried on at fourteen working faces simultaneously. The maximum distance between two consecutive working points will be 5.2 miles, and the minimum 3.3 miles.

The number of shafts now proposed is greatly reduced from that originally contemplated by Mr. Freeman. In order to complete the tunnel construction in a minimum time, the 1912 plan proposed four portals, fourteen shafts and one adit, giving 34 working faces in all. Considerable economy is effected by the elimination of nine shafts and one adit, each requiring a costly plant installation and an independent construction camp, besides the cost of the shaft construction itself. This also permits straightening and shortening the line between some of the working points. These economies amply justify the slightly longer construction period necessitated by the greater distance between working points.

The completion of the Bay Crossing Division of the aqueduct through which additional water is brought from the Spring Valley Company's sources in Alameda County, assures us an adequate water supply for about five years to come, and we know from our experience in the construction of the Mountain Division tunnels that it is economical to drive our tunnels for a much longer distance from a shaft, portal or adit than had formerly been assumed. In the Priest heading of our Mountain Division tunnel, a length of nearly four miles was driven and lined complete from the Priest Portal. With these points in mind, a careful review of the preliminary location was made, and it was found that by eliminating


SAN FRANCISCO BAY
DUMBARTON STRAIT
ALAMEDA
SAN MATEO
COUNTY
MOUNTAIN VIEW
ELEVATION IN FEET
0
500
1000
1500
2000
SAN FRANCISCO BAY
NEWARK SLOUGH


ALAMEDA COUNTY
SAN JOAQUIN COUNTY
PROFILE ALONG AQUEDUCT LINE
PIPE
TUNNEL
SHAFT
DISTANCE IN MILES FROM SAN FRANCISCO
DISTANCE IN MILES FROM TESLA PORTAL
SAN FRANCISCO BAY
LIVERMORE
PLEASANTON
NILES
IRVINGTON
MISSION SAN JOSE
RANCHO EL VALLE DE SAN JOSE
RANCHO SAN JOSE
TRANSMISSION LINE
AQUEDUCT TUNNEL
PIPE & TRANSMISSION LINES
TRACY
SAN JOAQUIN
LEGEND:
HETCH HETCHY WATER SUPPLY
OF THE CITY AND COUNTY OF
SAN FRANCISCO, CALIFORNIA
MAIN AQUEDUCT - COAST RANGE DIVISION
MAP AND PROFILE SHOWING
LOCATION OF CORE BORINGS AND
ADOPTED LOCATION OF AQUEDUCT
DEPARTMENT OF PUBLIC WORKS
C-752

a number of the shafts formerly proposed, it was possible to improve the location at several points and also to reduce the total length of the tunnel line from 31 miles under the Freeman plan to 28.6 miles, a saving of 2.4 miles.

Core Borings: To supplement the information obtained by geological surveys, over the surface of the ground, core borings were made during the spring of 1926. This work was done under Hetch Hetchy Water Supply Contract No. 110 by the International Diamond Drill Contracting Company. The diamond drill process was used. Fifteen holes, having an aggregate depth of 5,014 feet, were drilled at points which are indicated on the accompanying map and profile. All cores obtained were preserved in boxes and stored at Livermore, where they will be available for any inspection of contractors or other parties interested in the Coast Range tunnel work.

The fifteen borings are distributed along the whole length of the aqueduct between Tesla Portal and Irvington Gatehouse. A boring was made at or near each of the five proposed shaft sites. Some are located at points near the contact of two formations, where the study of surface conditions left some uncertainty as to which material would be encountered at tunnel grade. In several cases there was no uncertainty as to the character of the rock, but it was desirable to determine its hardness.

It should be understood that geologically speaking the region penetrated by the Coast Range tunnels is by no means unknown territory. As previously stated, a great deal of information from outside sources in regard to the geology was available in connection with the locations of 1912 and 1916.

The formations are of a well-defined character, and as a rule the cores from the borings confirm the conclusions already reached through examination of surface conditions.

The core borings indicate that satisfactory material for tunneling will be encountered throughout the Coast Range Division, and there is no reason to apprehend unusual construction difficulties or excessive costs in this tunnel work.

Respectfully submitted,

M. M. O'SHAUGHNESSY,
City Engineer.

Alternative Pipe Line Route With Pumping:

All plans for the Hetch Hetchy Aqueduct previous to the Freeman plan of 1912 contemplated terminating the San Joaquin pipe line at a small reservoir near the westerly edge of the San Joaquin Valley, and pumping the water thence through a pipe line to a summit tunnel, from which point a pipe line, with tunnels to reduce summit elevations, would conduct the water by gravity flow to the vicinity of Mission San Jose and thence to San Francisco.

The inital cost of such a pipe system with a capacity of 60,000,000 gallons daily would be about half the cost of a tunnel of 250,000,000 gallons daily capacity between the same two points, but when the cost of pumping and fixed charges are capitalized and added to the initial cost, it is found that the sum is about the same for the 60 m.g.d pipe system with pumping over Altamont crest as for the 250 m.g.d. tunnel which provides for over four times the volume with a gravity flow. The City would virtually be tieing up as much of its capital for 60 m.g.d. as for

250 m.g.d., besides which the 60 m.g.d. line would have to be paralleled with additional units and additional pumping capacity added from time to time to keep pace with the rapid growth of the City and of the peninsular district which is looking to San Francisco to furnish it with additional water. The time saving possible by adopting the pipe system is inconsiderable, and the cost of the pipe system cannot be justified by regarding it as a temporary expedient to postpone the tunnel investment. It would be a great economic mistake for the City to adopt the pipe system with pumping instead of the tunnel plan.

Bay Development

During the fiscal year ending June 30, 1926, the Bay Development of the Hetch Hetchy Water Supply Project, extending from a point near Irvington, Alameda County, to Crystal Springs Reservoir, San Mateo County, was completed and on May 21, 1926, it was placed in operation at full capacity by the Spring Valley Water Company, at the annual rental of $250,000 agreed upon in April, 1922.

This portion of the aqueduct consists of 19.33 miles of 60-inch riveted steel pipe, 3,165 feet of 42-inch flexible joint cast iron submarine pipe siphons crossing navigable channels, 3.6 miles of trestle supporting the pipe over the marshes adjacent to San Francisco Bay, 3,870 feet of steel bridge on concrete piers, a large concrete caisson at which connection is made between the pipe on the bridge and the submarine pipe, 9,007 feet of concrete lined tunnel through the ridge east of Crystal Springs Reservoir, 946 feet of concrete outfall canal at the west end of the tunnel, and a booster pumping plant at Ravenswood. The general layout of the Bay Development is shown on Map No. C-756, accompanying this report.

Bay Crossing Pipe Line:

The 60-inch riveted steel pipe line is made up of plates from 5/16 inch to 7/16 inch in thickness and is laid in a right of way varying from 60 feet to 100 feet in width, owned in fee by the City. This right of way will accommodate all future pipe lines necessary to increase the aqueduct capacity to the ultimate limit.

The riveted steel pipe is physically divided into three sections, the first of which, extending from Irvington to Newark Slough, is nearly 7.7 miles in length. The east end of this section is in the Western Pacific Railway right of way, just north of Irvington. Here the 60-inch pipe is connected to the new 44-inch Niles-Irvington pipe line, 15,620 feet (2.96 miles) in length, of the Spring Valley Water Company. Going west from this point the pipe is laid through flat cultivated farm land, where it lies in a trench from 7 to 9 feet deep for a distance of 6 miles, to the east edge of the salt marsh. Thence to the location of the first submarine siphon, at Newark Slough, the route crosses salt marsh and the pipe is supported on timber trestle for 1.7 miles. Newark Slough, a navigable waterway, is crossed by a 42-inch submarine pipe line, 405 feet in length. The second section of 60-inch riveted pipe, 1.4 miles long, extends from

El.
600
500
400
300
250

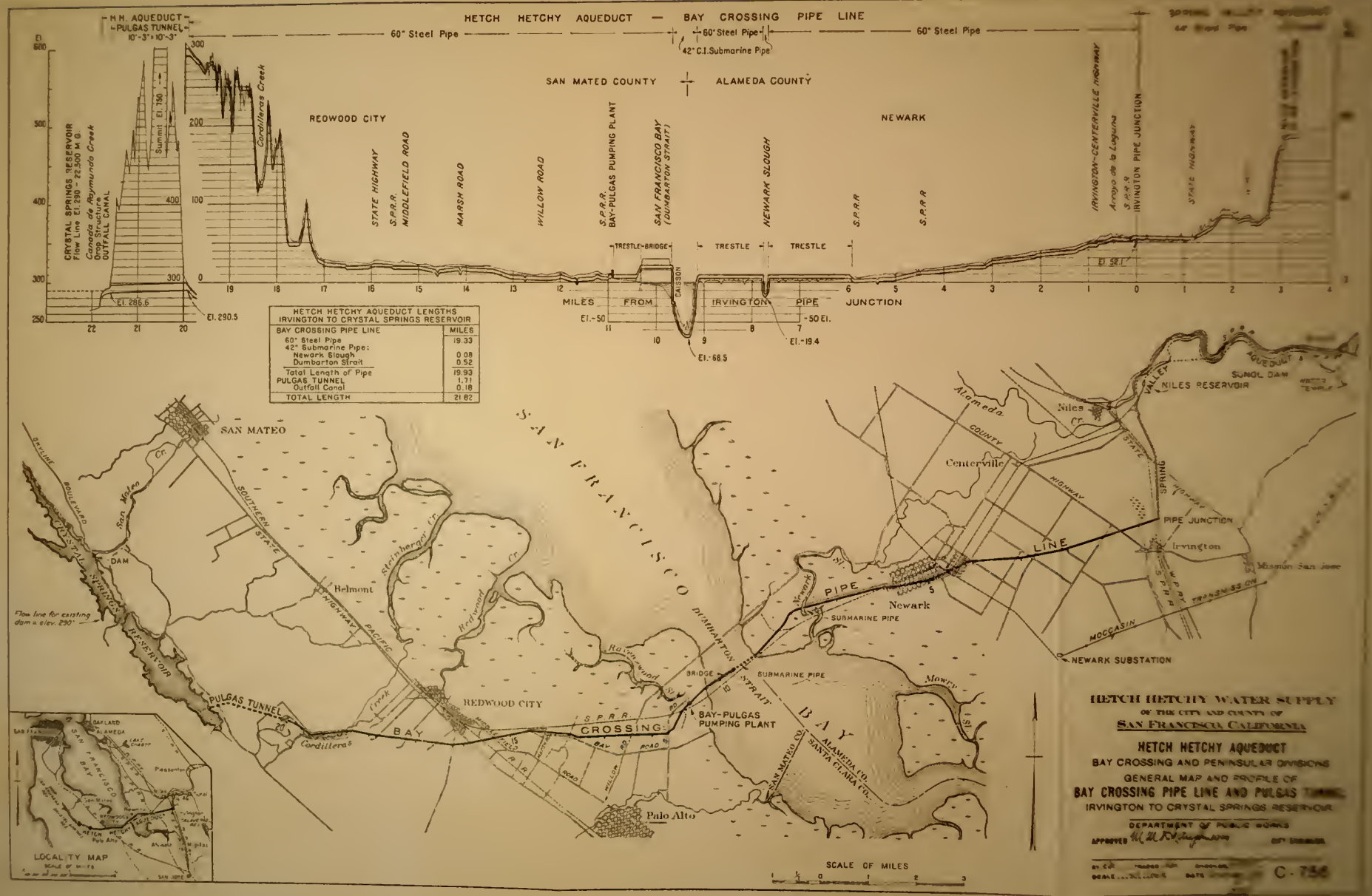
CRYSTAL SPRINGS RESERVOIR

SKYLINE

Flow line for ex
dam = elev. 29

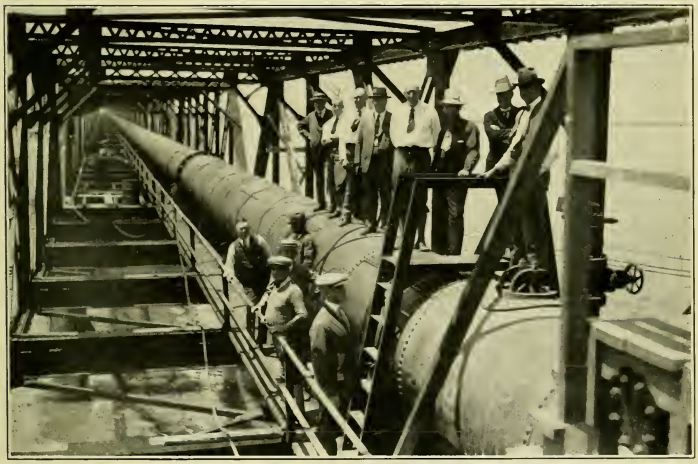
SAN FRANCISCO

LOCALI
SCALE o


HETCH HETCHY AQUEDUCT — BAY CROSSING PIPE LINE
H.H. AQUEDUCT
PULGAS TUNNEL
10'-3" × 10'-3"
60" Steel Pipe
60" Steel Pipe
42" C.I. Submarine Pipe
60" Steel Pipe
SAN MATEO COUNTY
ALAMEDA COUNTY
REDWOOD CITY
NEWARK
Cordilleras Creek
STATE HIGHWAY
S.P.R.R.
MIDDLEFIELD ROAD
MARSH ROAD
WILLOW ROAD
S.P.R.R. BAY-PULGAS PUMPING PLANT
SAN FRANCISCO BAY (DUMBARTON STRAIT)
NEWARK SLOUGH
S.P.R.R.
S.P.R.R.
IRVINGTON-CENTERVILLE HIGHWAY
Arroyo de la Laguna
S.P.R.R.
IRVINGTON PIPE JUNCTION
STATE HIGHWAY
CRYSTAL SPRINGS RESERVOIR
Flow Line El. 290 - 22,500 M.G.
Canada de Raymundo Creek
Drop Structure
OUTFALL CANAL
Summit El. 750
El. 286.6
El. 290.5
TRESTLE
BRIDGE
TRESTLE
TRESTLE
CAISSON
El. 92'
MILES FROM IRVINGTON PIPE JUNCTION
El. -50
-50 El.
El. -19.4
El. -68.5
HETCH HETCHY AQUEDUCT LENGTHS
IRVINGTON TO CRYSTAL SPRINGS RESERVOIR
BAY CROSSING PIPE LINE — MILES
60" Steel Pipe 19.33
42" Submarine Pipe:
Newark Slough 0.08
Dumbarton Strait 0.52
Total Length of Pipe 19.93
PULGAS TUNNEL 1.71
Outfall Canal 0.18
TOTAL LENGTH 21.82
SAN MATEO
San Mateo Cr.
SOUTHERN PACIFIC HIGHWAY
Steinberger Cr.
Belmont
Redwood Cr.
CRYSTAL SPRINGS RESERVOIR
DAM
Flow line for existing dam = elev. 290'
PULGAS TUNNEL
Cordilleras
REDWOOD CITY
Redwood Creek
SAN FRANCISCO BAY
DUMBARTON STRAIT
BRIDGE
SUBMARINE PIPE
S.P.R.R. CROSSING
BAY-PULGAS PUMPING PLANT
BAY
ALAMEDA CO.
SANTA CLARA CO.
SAN MATEO CO.
Palo Alto
Mowry
Alameda COUNTY
Centerville
Niles Cr.
NILES RESERVOIR
SUNOL DAM
SUNOL AQUEDUCT
VALLEY
STATE HIGHWAY
SPRING
PIPE JUNCTION
Irvington
Mission San Jose
TRANSMISSION LINE
PIPE LINE
Newark
SUBMARINE PIPE
NEWARK SUBSTATION
MOCCASIN
LOCALITY MAP
SCALE OF MILES
HETCH HETCHY WATER SUPPLY
OF THE CITY AND COUNTY OF
SAN FRANCISCO, CALIFORNIA
HETCH HETCHY AQUEDUCT
BAY CROSSING AND PENINSULAR DIVISIONS
GENERAL MAP AND PROFILE OF
BAY CROSSING PIPE LINE AND PULGAS TUNNEL
IRVINGTON TO CRYSTAL SPRINGS RESERVOIR
DEPARTMENT OF PUBLIC WORKS
C-756

Newark Slough to Dumbarton Strait over salt marsh and is entirely supported on timber trestle. At each side of Newark Slough and at the east shore of Dumbarton Strait connection is made between the riveted 60-inch steel pipe and the 42-inch cast iron siphon by tapered riveted pipe encased in a concrete anchor supported on pile foundation. Similar anchor structures are used at a few other points along the trestle. The Dumbarton Strait siphon, 2,760 feet in length, passes beneath the deeper part of the channel, reaching a maximum depth of 67 feet below mean sea level, to a point nearly ¾ mile from the west shore. At this point in the Strait a large concrete caisson structure, 81.5 feet in diameter, encloses the connection between the cast iron pipe and the riveted pipe, which is supported over the water to the west shore on a steel bridge. The caisson serves also as the east end pier of the bridge.

The third section of 60-inch riveted pipe, from Dumbarton Strait to Pulgas Tunnel, is nearly 10.3 miles long. The easterly ¾ mile is supported on the steel bridge and the following 0.5 mile on timber trestle



BAY CROSSING PIPE LINE, HETCH HETCHY AQUEDUCT, BAY DEVELOPMENT

60-inch pipe line on steel bridge crossing Dumbarton Strait. Space for second pipe line at the left. View looking west from caisson at east end of bridge.

over salt marsh to the Bay-Pulgas Pumping Plant. From this point the pipe line is laid along the most direct practicable route through cultivated lands and improved property, passing through the southwesterly portion of Redwood City, and getting support on the low rolling hills on the north side of Cordilleras Canyon. In this distance the pipe is

buried in a trench generally from 7 to 9 feet deep, excepting at the crossing of nine small gullies in the Cordilleras region, where it is supported on concrete piers and steel bents. The steel pipe at its west end connects with Pulgas Tunnel at elevation 290.5.

To permit cutting out a section of the pipe line for repair or other work without emptying the entire line, two 42-inch gate valves and one 36-inch gate valve are installed. Many blow-off valves and air valves are located on the pipe line at advantageous points.

The riveted steel pipe line was tested after installation under pressures at least 25 per cent in excess of the maximum working pressure, and all leaks made tight. The maximum test pressure was 200 pounds per square inch. A coating of Biturine enamel was applied to the inside and outside of the pipe while hot by dipping in a vertical tank at the shop. In the course of laying the pipe all broken spots in the coating were repainted and just prior to putting water through the pipe the inside coating was thoroughly inspected and surfaces found imperfectly coated were repainted.

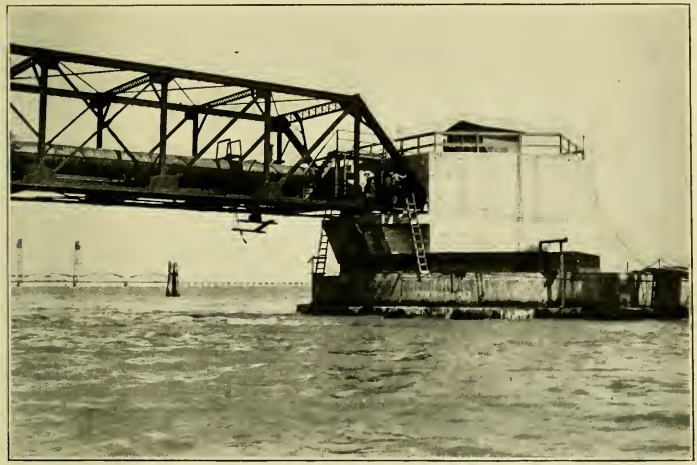
The Western Pipe and Steel Company of California, under Contract No. 90, furnished and installed this pipe. It was placed in service at part capacity in connection with the submarine pipes of the Spring Valley Water Company system on September 12, 1925, and at full capacity in connection with the City's submarine pipe at Dumbarton Strait May 21, 1926.

Dumbarton Strait Bridge:

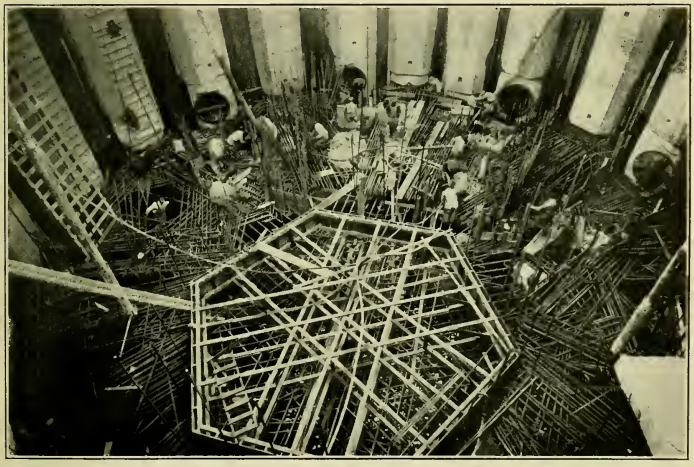
From a point near the navigable channel of Dumbarton Strait to the west shore a steel bridge 3,875 feet long, consisting of 36 steel spans supported on concrete piers and designed to support two 76-inch pipes, has been constructed.

Bridge Piers: Contract No. 95, for constructing the bridge piers and end caisson, was performed by Healy-Tibbits Construction Co.

With the exception of the east end pier or caisson, each pier consists of two reinforced concrete cylinders braced by concrete beams and supported on a heavy concrete base having a foundation of from 52 to 60 piles. The 36 piers of this type range in height from 25 feet to 51 feet, depending upon the nature of the clay bottom. The procedure in building each of these piers began with the construction of a cofferdam of steel or wood sheet piling, slightly larger than the pier base. The mud within the cofferdam was excavated to a depth of from 10 to 30 feet, where fairly stiff blue clay was encountered. Piles spaced at 3 foot centers were then driven below this elevation to a penetration of from 30 to 50 feet. A tremie concrete seal 2 feet in depth was then placed and after a lapse of five days the water was pumped out from the cofferdam. Piles were cut off to proper height, collapsible forms set up, reinforcing steel placed and the concrete piers poured in the dry. After the concrete had set the forms and the cofferdam were removed to be used in the construction of other piers.



East end of pipe line bridge and end pier or caisson containing connections to west end of Dumbarton Strait submarine siphon. (Dumbarton highway bridge in background.)



Interior of caisson at east end of Dumbarton Bridge, showing reinforcing steel in bottom and the four 42-inch connections for submarine pipe lines at the base of the cofferdam cylinders.

DUMBARTON BRIDGE, HETCH HETCHY AQUEDUCT, BAY DEVELOPMENT

End Pier or Caisson: The east end pier of the steel bridge is a large reinforced concrete structure which contains and anchors the connections between the submarine pipes under the bay and the riveted pipes on the bridge. Provision has been made for connections between two pipe lines on the bridge and four submarine pipe lines, with six valves for sectionalizing the system for repairs or in emergency. This end pier or caisson is hexagonal in plan, tapering upward from a base diameter of 81½ feet (circumscribing circle) to a short diameter at the top of 40 feet. Down through the central portion a well 24 feet in short diameter is constructed to permit riser pipes being placed to join the submarine pipes which enter at the base. Four 42-inch pipes pass through the concrete base, providing for the connection of four 42-inch submarine pipes, including the one now completed. This pier is supported on 715 piles driven into clay and gravel strata to a depth of about 100 feet below the water level. Twenty-one concrete cylinders approximately 8 feet in diameter, with concrete and steel connecting webs, form a circular exterior cofferdom within which the remainder of the structure was built, and also serves as an essential part of the pier. Four additional concrete cylinders located inside of the cofferdam form part of the foundation. The pier of concrete is 99 feet in height, resting on piles and extending from elevation —74 at the bottom of the cylinders to elevation +25 at the caisson top. Within the well one 36-inch gate valve is now installed with operating platform. This valve is operated by a water motor which is placed on the top of the caisson. Provision is made for installing three additional 36-inch valves within the well for control on the future submarine pipe lines. The well of the caisson is covered with a tar paper and gravel roof over wood planking, supported on steel I-beams.

In building this large caisson, first the foundation piles under the central portion of the pier were driven. Following this the four interior concrete cylinders were placed by driving four 9½-foot circular steel shells as small individual cofferdams, excavating the clay and sand from within each steel shell, driving 9 foundation piles within each cylinder, placing forms and reinforcing steel, then pouring the concrete in the dry. The circular ring of 21 concrete cylinders of the outer wall was then built by a similar process to that used on the interior cylinders, using as a cofferdam for each cylinder a circular steel shell made up of plates ⅝ to ⅞ inch in thickness, 9½ feet in diameter and 81 feet in length, driven 48 feet in the mud, sand and clay. The bottom 5½ feet of the steel shell was made to be detached and was left permanently in the firm yellow clay when the remainder of the shell cofferdam was removed to be used on the construction of other cylinders. After excavating the material from the interior to the bottom of each steel shell, nine foundation piles were driven and a concrete base poured. Above this base, precast concrete forms 88 inches by 78 inches, and reinforcing steel were placed and the forms filled with concrete to elevation —8. At this point a joint was made to facilitate the removal process described later, and

a hollow core was left in the cylinder in the upper 9 feet or to elevation +1.0. This elevation is 2.25 feet above mean sea level. To connect the cylinders two rows of sheet piling were driven between adjacent cylinders, closing in to sheet piling previously cast in the concrete forms. After excavating mud and clay from the enclosure thus formed, tremie concrete was poured making a web or wall to the top of the precast forms, or to elevation+1.0.

On July 1, 1925, the 25 cylinders and 16 of the 21 webs connecting the cylinders of the cofferdam were complete.

On top of the ring formed by the 21 concrete cylinders and their connecting webs, a thin circular concrete wall 5 feet in height was built from elevation +1.0 to elevation +6.0. This completed the cofferdam construction.

The mud and clay were excavated from within the cofferdam by suction dredging, using jets to loosen the material and centrifugal pumps to remove the mixture of mud and water. The pile butts projecting above the desired elevation of the bottom of concrete were cleaned of mud by high pressure jets. After first placing a layer of rock 1 foot in depth on the excavated clay foundation ,a layer of tremie concrete 10 feet in depth was placed in a continuous pour, using two concrete mixers and 8-inch tremie pipes. The tremie concrete base was permitted to set 18 days, during which time the contractor sealed openings which had been left at the top of the cofferdam to admit water during the suction dredging process and prevent developing unbalanced hydrostatic pressure previous to placing the tremie seal.

The water was then pumped out and under the head of 37 feet the cofferdam developed very little leakage or deflection. The pile butts were cut off, the surface of the tremie concrete cleaned and broomed, forms and steel placed and all further concrete poured in the dry. During the period of pouring the concrete it was necessary to install pipe connections and other metal work and to set the last bridge span in position on the caisson. The concrete pouring was completed January 15th, 1926, and the contract completed with removal of the upper part of the cofferdam (down to elevation —8.0 feet) May 22, 1926. The total payment under Contract No. 95 was $1,181,400. After completion of all piers two coats of asphalt were applied to the concrete surfaces from low water line to high water line as a protection against infiltration of salt water.

Steel Bridge Superstructure: This structure, furnished and erected by the United States Steel Products Company under Contract No. 93, was described in the report for 1924-25, page 111. On June 30, 1925, 35 of the 36 spans had been erected. The final span, that at the easterly end of the bridge, could not be placed until the completion of the caisson, which is the east end pier of the bridge. The construction of the bridge was practically completed by the placing of this span on January 2,

1926, but work on minor details and retouching of the protective paint (Biturine enamel) continued for some time longer.

The total payments under Contract No. 93 amounted to $232,913.

Trestles and Wood Cover for Pipe on Trestle:

The construction of trestle to support the pipe across the marsh land (Contract No. 96) and of wood cover over portions of the pipe line (Contract No. 108) was described in the 1924-25 report, page 112.

Submarine Pipe Lines:

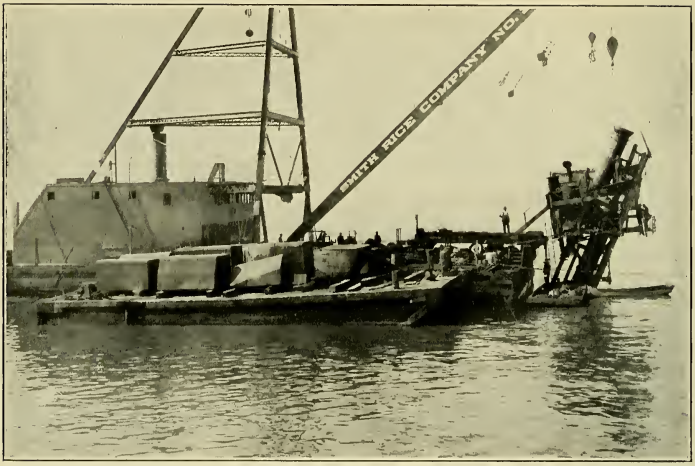
Submarine pipe, 42 inches in diameter, of cast iron, with ball and socket flexible joints, has been laid in the crossing of the navigable channel and adjacent deep water of Dumbarton Strait, a distance of 2,760 feet, and across Newark Slough, 405 feet. The pipe was furnished under Contract No. 101 by the United States Cast Iron Pipe and Foundry Company. The order included 263 pieces of flexible joint pipe 2 inches thick, in 12-foot laying lengths, each weighing about 6½ tons, and about 20 special pieces to be used in making end connections to the adjacent riveted steel pipe. The total weight was 1,766 tons. It was made at Burlington, N. J., transported by water to San Francisco, and unloaded from the steamship onto barges which were towed to the site of the work. The inner surface of the bell or socket of this pipe is ground with great accuracy to form a segment of a spherical surface, permitting a maximum deflection of 10° 45′ at any joint. The pipe was tested at the foundry under a hydrostatic pressure of 375 pounds. Delivery was completed March 20, 1925, at a total cost of $208,496.98.

Contract No. 105, for construction of submarine pipe lines, including digging the trench, placing broken rock bed, submarine trestle work, transporting the pipe on barges from San Francisco, laying the submarine pipe and refilling the trench over the pipe, was awarded to Healy-Tibbitts Construction Company August 22, 1924. The first work performed under this contract was the construction of the Newark Slough siphon. After excavating the trench and placing the rock bed, the system used in laying this pipe, which covers a distance too short for a cradle to work in, was to erect a temporary trestle of two-pile bents straddling the desired position of the pipe, with a temporary platform supported slightly above high water. Permission was readily secured from the War Department to temporarily close the channel to navigation during the time necessary for the work, this traffic being of little importance. On the platform the pipe was assembled and the lead joints poured, calked, deflected and tested. Over the submarine pipe a track was supported on the pile bents and a short car, mounted on two axles, placed over each length of pipe. A heavy steel strap was placed around each end of the 12-foot length of pipe and from this a long threaded rod connected to the car above. Each car supported one length of pipe by means of a heavy nut on each of the two rods bearing on a plate on the car frame. To lower the pipe, the assembling platform was removed, the supporting nuts on the cars were turned to lower the rods, and the

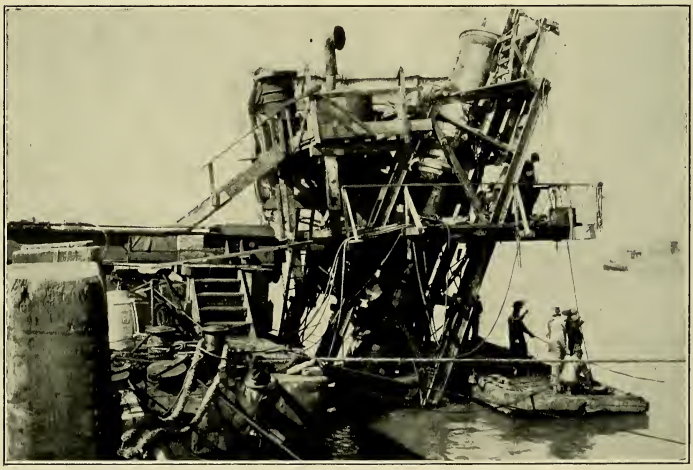
joints were deflected vertically by lowering the rods different distances to suit the prepared bed. A rock fill extending to a point half way up on the pipe was placed and the trench then filled with excavated material consisting of clay and mud. An air test of 50 lbs. per square inch indicated a leak at one joint and after calking this with lead, working inside of the pipe, a satisfactory hydrostatic test of 170 lbs. per square inch for a period of 24 hours was secured with no leakage.

This siphon was placed in use in conjunction with the 60-inch steel pipe line previously mentioned, on September 12, 1926.

The Dumbarton Siphon required the placing of 228 twelve-foot pieces of the flexible joint pipe in a depth of water ranging from 0 to 73 feet with a tidal current of 4 miles per hour in each direction and a tidal range of 11 feet. This work was started in January, 1925, with excavation of trench. The trench was excavated in blue mud, blue and yellow clay, and sand with a small amount of fine gravel. It ranged in depth, due largely to uneven bay bottom, from 10 to 24 feet. It has a width of 12 feet at the bottom and a pay width of from 72 feet to 156 feet at the top, which amounted to 87,604 cubic yards. This material was handled with a large dredge using a 4-yard clamshell bucket and 220-foot boom. For a distance of 168 feet, near the connection to the end caisson, where a horizontal curve is placed in the line, the system adopted for placing pipe was similar to that used at Newark Slough, lowering from a temporary trestle. In the first 252 feet east of the end caisson, a submerged trestle consisting of two-pile bents at 12-foot intervals, with caps and stringers to support the submarine pipe, was built at a level from 5 to 10 feet below the mud line. Along the horizontal curve, brace piles were driven and a tremie concrete casing poured around the pipe and anchored to the brace piles. This, together with a heavy bank of crushed rock placed on the outside of the curve, resists the side thrust at the flexible joints of the pipe due to internal hydrostatic pressure. To connect the section of pipe lowered from temporary trestle to the pipe set in the concrete caisson wall, it was necessary for divers to make an underwater joint by calking lead wool to the amount of 411 pounds into the joint. From a point near the end of the horizontal curve the pipe was placed through a cradle made up of steel beams bolted up into a boxlike cage which acted as a guide and support for the pipe as it descended through the water. The cradle used here was one used in laying the New York City submarine pipe across the Narrows between Brooklyn and Staten Island, and was shipped from the East for use in this work. The cradle was curved longitudinally to nearly ¼ circle and was supported with one end above the water by a derrick barge of 100 tons capacity. The lower end was placed in the trench on the line desired and near the end of pipe previously placed from trestle. The 12-foot lengths of pipe were then lowered through the cradle in the form of a chain by making one joint after another at the upper end of the cradle, until the lowest pipe reached the bottom and was fitted into the string of pipe previously placed. Here again a lead wool joint was



Laying 42-inch submarine pipe line from derrick barge. Showing cradle suspended from barge and piece of pipe being placed in cradle.



View showing upper section of cradle and pipe in position in cradle. The cradle curves back under the barge and its lower end rests on the bottom of the dredged trench.

DUMBARTON STRAIT SUBMARINE SIPHON, HETCH HETCHY AQUEDUCT, BAY DEVELOPMENT

made by divers. The operation required ten days' time and during this period the cradle was secured to a pile structure to prevent hinging action due to the tide and for safety in case of storms. In advance of pipe laying in the trench, excepting for a distance of 467 feet where firm sand bottom existed, a rock bed was placed by clam shell buckets to a depth of from 22 inches to 4 feet, and smoothed to an even grade by dragging a heavy leveler along the trench with a steam winch. Each piece of the submarine pipe was coated inside and outside with Biturine priming coat and Biturine enamel, applied hot with a brush before placing the pipe in the cradle. The laying of the pipe with the cradle handled by the derrick barge started October 1st, and continued only until October 31, 1926. A total number of 180 twelve-foot lengths were placed by means of the cradle. The method of placing this pipe was to continue the string or chain of pipe by placing an additional section on the topmost section, which was standing in a nearly vertical position in the cradle, pour the lead, calk and deflect the joint, and then drag the cradle and barge 12 feet forward. This movement caused one length of pipe to slip out of the lower end of the cradle into its final position on the prepared rock bed and also made room for one joint on top. Care was used to keep the barge on exact line during the continuous laying operation day and night by the use of range sights and colored lanterns. The above operation was repeated until the cradle reached shallow water, near the east shore, and temporary trestle was again resorted to for placing the remaining 34 lengths of pipe.

When entering the spigot of a pipe into the bell of the pipe previously placed in position, great care was taken to have the highly polished bell free from dirt and moisture and the spigot exactly seated. A thin film of grease was applied to the finished surface for lubrication. Lead was heated to a temperature of 750 degrees in a kettle which was mounted on the top of the cradle. A 1½-inch pipe conducted the melted lead from the kettle to the joint. The weight of poured lead used was 380 to 400 lbs. per joint. The joint was calked by forcing small lead cylinders by means of screws through threaded holes in the perimeter of the bell. Rotating air drills were used to drive the screws and force the lead in under great pressure. In each joint 140 pellets ⅝ inch in diameter by 1¾ inches long, having a total weight of 31 pounds, were used. Following the calking, the joint was deflected, then returned to the central position, and a hydrostatic pressure test applied, using a double diaphragm apparatus, which confines the water to the joint portion of the pipe by pressing rubber gaskets to the pipe walls. After testing the first 36 joints made up in this siphon and finding them water tight, only one in each ten joints was tested. During the laying of the pipe examinations were carried on with the assistance of a diver and close soundings recorded of the vertical position of each joint. On completing the laying operation all water was removed from the pipe and a close examination of each joint and an instrumental survey made to determine the exact position. A number of joints were found deflected beyond the allowable limit for unanchored joints. These resisted efforts to pull them

to correct position and were therefore anchored during the process of covering of the pipe. Such anchorage was generally provided by placing large masses of broken rock against the sides and over the top of the pipe. The greatest distance from true center line found in the pipe line was 2.7 feet.

For the entire length of the submarine pipe broken rock was placed along the sides and in certain sections, where vertical bends occurred, the pipe was covered.

To determine the tightness of the joints, after reaching their final position, which required the bending of each joint passing through the cradle from 8 to 10 degrees and then straightening, an air test was applied to the completed submarine line. On each end of the 2,760-foot siphon a blind flange was bolted and 50 pounds per square inch air pressure applied. Air bubbles rising to the surface during this test revealed small leaks in two lead wool joints made under water by the divers. All joints poured with hot lead and calked with pellets and one lead wool joint made by divers were tight. The leaking joints were calked by drilling and threading holes through the spigot from the inside and forcing lead pellets into the lead previously placed by the divers. Following this work, the entire Bay Development was placed in operation on May 21, 1926, and is now delivering 34 million gallons daily from Alameda County sources to Crystal Springs Reservoir, taking the water at 100 foot head and running against 292 foot head plus friction at a pumping cost of less than ¾ cent per 1,000 gallons.

Backfilling of the trench excavated for the submarine pipe was finished on June 17, 1926. Payments for the work done under Contract No. 105 totaled $354,606.

Bay-Pulgas Pumping Plant:

This plant was described in the report for the fiscal year 1924-25, page 114. It was first put in operation at part capacity September 12, 1925, and at full capacity on May 21, 1926. The delivery of water was found to be above the guaranteed amount.

System of Operation:

The present system of operation of the Bay Development Aqueduct under the Spring Valley Water Company agreement is as follows: Water from Alameda County sources, drawn from storage in Calaveras Reservoir and the Livermore Valley gravels, is conveyed from Sunol through an aqueduct consisting of alternating tunnels and concrete flumes to a reservoir of 5,114,000 gallons capacity near Niles. From this reservoir, the high water surface of which is at elevation 183 feet, a 44-inch pipe line about three miles long connects to the east end of the Hetch Hetchy Water Supply pipe line near Irvington. The water flows by gravity from the Niles Reservoir to the Bay-Pulgas Pumping Plant, at which point the pressure is "boosted" to that necessary to cause the water to flow on through the pipe to the east portal of the Pulgas Tunnel. Flow through

the tunnel is by gravity. At the west end of the tunnel the water is conducted in the concrete lined outfall canal to Canada de Raymundo Creek and then flows northerly in the creek channel into Crystal Springs Reservoir. (See map C-756 accompanying this report.)

Property Line Posts and Signs:

During the earlier months of 1926 about 400 redwood posts were set along the line of the completed Hetch Hetchy Aqueduct from Irvington to Crystal Springs Reservoir, to mark the boundaries of Hetch Hetchy Water Supply lands and rights of way owned by the City.

These posts are of extra merchantable redwood, 4″x4″x5′-4″ (rough dimensions), surfaced four sides, the lower 3′-6″ treated with a preservative and the upper portion given two coats of white paint. The posts are lettered "H.H.W.S.-SAN FRANCISCO" in black on one or two faces and the number of the survey station opposite which the post is set is painted on the post. After lettering, the upper part of the post was varnished to protect the white paint and black lettering.

In general, the posts were set to a depth of 3 feet in the ground at the intersections of Hetch Hetchy fee land or right of way side lines

DROP STRUCTURE, PULGAS TUNNEL OUTFALL CANAL, HETCH HETCHY AQUEDUCT, BAY DEVELOPMENT

Water conveyed through the Bay Crossing pipe line and Pulgas Tunnel is discharged here into Crystal Springs Reservoir basin. The flow at the time of the photograph was at the rate of 34,230,000 gallons daily.

with street lines and other property lines. "No Trespassing" signs were placed on several structures.

For the information of the general public and City employees as to the location of the Hetch Hetchy Aqueduct, signs reading "AQUEDUCT, HETCH HETCHY WATER SUPPLY, SAN FRANCISCO," were placed at the principal road crossings.

CONTRACT NO.	TITLE OF CONTR
Col. 1.	Col. 2
TOTALS BROUGHT FORW	
61	Construction of the Hetch Hetchy Dam Appurtenant Works
62	Furnishing & deliveri 18' Air Pipe
63	Furnishing & deliveri Refrigerating Machin Equipment
64	Furnishing & deliveri Self-Dumping Skips & Side Plates.
65	Furnishing & deliveri Station Pump for Big Shaft
66	Furnishing & deliverir 47" x 39" Slide Gates fo Hetch Hetchy Dam
67	Furnishing & deliveri 35" x 47" Slide Gates f Hetch Hetchy Dam
68	Furnishing & deliveri 5 Ft. Balanced Valves Hetch Hetchy Dam
69	Furnishing & deliveri 3 Ft. Balanced Valves Hetch Hetchy Dam
70	Furnishing & deliveri Electric Traveling
71	Furnishing & deliveri Station Pump for Second Garrotte Sh
72	Furnishing & delivei Air Pipe
73	Furnishing & delivei Standard Wrought with couplings & prot
74	Furnishing & delivei Tie-Plates
75	Placing, tamping & f ballast in the track Hetch Hetchy Rails
76	Furnishing & delive 24" Air Pipe
77C	Construction of Aqu Tunnels in Mtn. Div. cost-plus-fee basi
78	Furnishing & deliv Electric Transm Line Conductors
79A	Furnishing & delive Water Wheels for Moccasin Creek Pow Plant
79B	Furnishing & delivei Valves for Moccasi Creek Power Plan
80	Furnishing & delive Electric Generator Accessories for Moc Creek Power Plan
TOTALS	

EXPLANATION OF AB
H.H. - Hetch Hetchy reser
Mtn. - Mountain division
R.R. - Hetch Hetchy Rail
Moc. - Moccasin Creek Po

CONTRACTS — HETCH HETCHY WATER SUPPLY

No.	Name of Contract (Col 1)	Division (Col 3)	General Description (Col 4)	Location of Work or Location for which Material etc. was Purchased (Col 5)	Col. 6	Amount of Bond for Faithful Performance (Col 7)	Date of Opening Bids (Col. 8)	No. of Bids (Col 9)	Highest Bid (Col. 10)	Lowest Bid (Col 11)	Successful Bid (Col. 12)
	[illegible]					$ 415,150			$2,878,331.42	$2,174,874.48	$2,195,017.52
[illegible]	[illegible] Dam & Appurtenant Works	H H	Dam to be of concrete masonry with a maximum height above foundations of abt 300 ft constructed with a view to future enlargement	H H Reservoir		$ 400,000	July 30 1919	2	5,475,910.00	5,447,792.50	5,447,792.50
[illegible]	Furnishing & delivering [illegible] Pipe	Mtn	[illegible] ft of [illegible] dia riveted pipe made of [illegible] gage steel & fittings	Aqueduct Tunnels - Mtn Div		1,000	June 6 1919	2	5,282.40	5,224.20	5,224.20
[illegible]	Furnishing & delivering [illegible] Machines & [illegible]	Mtn	7- Refrigerating & Cooling Plants	Boarding Houses at permanent camps		1,500	June 9, 1919.	3	10,368.30	5,775.00	5,775.00
[illegible]	Furnishing & delivering [illegible] Dumping Skips & [illegible]	Mtn	4 Self-dumping skips for vertical shafts	Big Creek Shaft and Second Garrotte Shafts		1,000	July 2, 1919	2	3,920.00	2,929.00	2,929.00
[illegible]	Furnishing & delivering [illegible] Pump for Big Creek Shaft	Mtn	1 Motor Driven Centrifugal Turbine Pump 250 gals per min.	Big Creek Shaft		900	July 23, 1919	4	3,670.00	2,287.50	2,287.50
[illegible]	Furnishing & delivering [illegible] Slide Gates for Hetch Hetchy Dam	H H	6 - Slide Gates complete with all operating mechanism	Hetch Hetchy Dam		40,000	Mar 3, 1920	4	170,000.00	121,000.00	121,000.00
[illegible]	Furnishing & delivering [illegible] Slide Gates for Hetch Hetchy Dam	H H	6 - Slide Gates complete with all operating mechanism.	Hetch Hetchy Dam		20,000	June 2 1920	1	170,000.00	170,000.00	170,000.00
[illegible]	Furnishing & delivering [illegible] Balanced Valves for Hetch Hetchy Dam	H H	6 - Balanced Valves complete with all operating mechanism	Hetch Hetchy Dam		50,000	Mar. 10, 1920.	2	189,200.00	173,100.00	173,100.00
[illegible]	Furnishing & delivering [illegible] Balanced Valves for Hetch Hetchy Dam	H H	6 - Balanced Valves complete with all operating mechanism	Hetch Hetchy Dam		25,000	Mar. 31, 1920.	1	98,500.00	98,500.00	98,500.00
[illegible]	Furnishing & delivering Electric Traveling Crane	Moc	270,000 lb. crane, 32 ft lift, 50 ft. span.	Moccasin Creek Power House.		5,000	Dec 6, 1922	6	39,835.00	24,675.00	30,475.00
7[illegible]	Furnishing & delivering [illegible] Pump for Second Garrotte Shaft	Mtn	1- Motor Driven Centrifugal Turbine Pump 400 gals. per min	Second Garrotte Shaft		500	July 23, 1919.	5	2,295.00	1,555.80	1,702.00
7[illegible]	Furnishing & delivering [illegible] Pipe	Mtn	3990 ft. of 24" dia. riveted pipe made of #16 gage steel and fittings	Aqueduct Tunnels Mountain Division		1,000	Aug. 6, 1919	3	9,598.50	8,102.10	8,102.10
73	Furnishing & delivering Standard Wrought Pipe Blk with couplings & protectors	Mtn	5,000 ft - 1" Std W.I. Pipe Blk 5,000 " - 1½" " " " 7,000 " - 2" " " " 7,000 " - 4" " " "	Aqueduct Tunnels Mountain Division		2,000	Aug. 13, 1919.	7	8,128.60	6,678.50	6,678.50
74	Furnishing & delivering Tie-Plates	R.R	22,000 Tie-Plates for 60 lb rails of the "Harriman" type.	Hetch Hetchy Railroad		1,000	Oct. 1, 1919.	2	5,758.50	4,625.50	4,625.50
75	Placing, tamping & finishing ballast in the track of the Hetch Hetchy Railroad	R.R.	Track Ballast	H.H.R.R. between Middle Fork trestle and Big Creek Camp.		1,000	Oct. 8, 1919.	2	6,000.00	6,000.00	6,000.00
76	Furnishing & delivering 24" Air Pipe	Mtn	5005 ft. of 24" dia riveted pipe made of #16 gage steel 300 cinch bands made of #12 gage steel	Aqueduct Tunnels - Mtn. Div.		1,500	Jan. 28, 1920.	1	12,431.10	12,431.10	12,431.10
77C	Construction of Aqueduct Tunnels in Mtn Div on a cost-plus-fee basis	Mtn	Concrete lined tunnel 10'-3" x 10'-3", horse shoe section 18.3 mi long	Early Intake to Priest Reservoir		100,000	Apr 21, 1920	2	8,952,380.00	7,802,952.80	7,802,952.80
78	Furnishing & delivering Electric Transmission Line Conductors		177 miles of transmission line cable	Hetch Hetchy Transmission line.		48,000	Jan 10, 1923	2	494,242.00	191,328.86	191,328.86
79a	Furnishing & delivering Water Wheels for Moccasin Creek Power Plant	Moc	Four 25000 H.P. impulse water wheel units	Moccasin Creek Power Plant		100,000	Apr. 12, 1922	2	267,000.00	248,800.00	248,800.00
[illegible]	Furnishing & delivering [illegible] for Moccasin Creek Power Plant	Moc	Eight Gate Valves operated by Hydraulic Cylinders	Moccasin Creek Power Plant.		10,000	Apr 12, 1922	9	116,248.00	37,580.00	37,580.00
80	Furnishing & delivering Electric Generators and accessories for Moccasin Creek Power Plant	Moc	Four 20,000 KVA Generators and one Motor-generator Exciter Set.	Moccasin Creek		100,000	Apr. 12, 1922	3	304,695.00	260,285.00	260,285.00
Totals									$19,223,793.82	$16,806,497.34	$16,832,586.58
									Does not include contracts not awarded		

No.	Contractor (Col. 13)	Contractor's Address (Col 13A)	Date of Award (Col 14)	Date of Signing Contract (Col. 15)	Time Allowed in Days (Col 16)	Date of Acceptance (Col 17)	Total Payments: Contract Items (Col 18)	Total Payments: Extras & Deductions (Col 19)	Total Payments: Total Amount Paid (Col 20)	Col 21	Remarks	No.
							$2,337,956.6[illegible]	[illegible]	$1,468,220.65			
[illegible]	Utah Construction Co	824 Phelan Bldg S.F	Aug 1, 1919	Aug 12, 1919	900	June 30, 1923	6,105,307.51	+ 15,499.35 - 374,138.83	5,746,098.71	4 3	[illegible]	6[illegible]
[illegible]	Western Pipe & Steel Co	444 Market St S.F	June 11, 1919	June 28 1919	75	July 31, 1919.	5,224.20	- 236.8[illegible]	4,987.40	33	[illegible] substituted for [illegible]	[illegible]
[illegible]	Walter S. Leland	67 Second St S.F.	June 13, 1919.	July 9, 1919.	60	Oct. 24, 1919.	5,775.00		5,775.00	107	8 days extension	[illegible]
[illegible]	Michel & Pfeffer Iron Works	1415 Harrison St S.F	July 9, 1919	July 28 1919	18	Sept 15, 1919	2,929.00	- 22.75	2,906.25	49	30 days [illegible] granted acct changes in deliveries made [illegible] $22.75 deducted for labor performed by city	[illegible]
[illegible]	Worthington Co. Inc	Sharon Bldg. S.F	July 30, 1919	Aug 14, 1919.	100	Mar. 19, 1920.	2,287.50		2,287.50	218	90 days extension granted acct labor trouble.	[illegible]
[illegible]	Coffin Valve Co	Monadnock Bldg.	Mar. 5, 1920	May 19, 1920	Feb. 28, 1921	Feb 24, 1922	121,000.00	3,724.35	124,724.35	747	Extra $3,724.35 to cover Bonus, Test Pcs & Freight $800 and to R Hunt for inspection	[illegible]
[illegible]	Union Machine Co	934 Brannan St.	June 4, 1920	June 9, 1920.	June 30, 1921	Jan 20, 1922	170,000.00	4,329.82	174,329.82	225	Bids of Mar 24 & Apr [illegible] rejected acct excessive price. Extra to cover Bonus, Test [illegible]	[illegible]
[illegible]	Wm. Cramp & Sons Ship & Eng. Bldg. Co	Philadelphia, Penn	Mar. 19, 1920.	Mar. 26, 1920.	Feb 28, 1921.	Nov. 2, 1921	173,100.00	4,080.13	177,180.13	355	Extra $4,080.13 to cover [illegible] $1,680. paid to R Hunt for inspection	[illegible]
[illegible]	Wm. Cramp & Sons Ship & Eng. Bldg. Co	Philadelphia, Penn	Apr. 2, 1920.	Apr. 14, 1920.	Feb. 28, 1921.	Apr. 27, 1921	98,500.00	7,373.18	105,873.18	378	Extra $7,373.18 to cover Freight & Bonus	[illegible]
[illegible]	Pawling & Harnischfeger Co.	32 Beale St., S.F	Dec 14, 1922	Jan 8, 1923	Mar 31, 1923	Aug. 5, 1923	30,660.80		30,660.80	209		[illegible]
7[illegible]	Allis-Chalmers Mfg Co	Rialto Bldg S.F	July 30, 1919.	Aug. 7, 1919	85	Mar. 19 1920.	1,702.00		1,702.00	235	Lowest Bid rejected acct error in estimate. 140 days extension acct labor trouble	7[illegible]
7[illegible]	Montague Pipe & Steel Co	Hobart Bldg. S.F	Aug. 11, 1919	Aug 15, 1919.	120	Nov. 11, 1919	8,102.10		8,102.10	88		72
73	R.W. Kinney Co	586 Howard St. S.F.	Aug. 15, 1919.	Sept. 10, 1919	15	Sept. 11, 1919.	6,678.50		6,678.50	27	12 days extension acct labor trouble	73
74	United States Steel Products Co	Rialto Bldg. S.F	Oct. 8, 1919.	Oct. 21, 1919.	10	May 6, 1920.	4,496.63		4,496.63	198	185 days extension acct. labor trouble.	74
75	W.H. London	San Francisco	Oct. 10, 1919.	Oct 16, 1919.	90	Dec. 17, 1919	3,426.13	- 527.04	2,899.09	63	Contract called for 4 miles. About 2 miles completed. Contractor released from further work. $527.04 deducted for unfinished surfacing & [illegible] charges due City.	75
76	Montague Pipe & Steel Co	Hobart Bldg. S.F	Jan. 30, 1920.	Feb 6, 1920.	155	Jan. 25, 1922	12,431.10	12,353.40	24,784.50	353	Extra $12,[illegible] for [illegible] ft of pipe & 300 cinch bands, authorized by Bd. of Wks.	76
77C	Construction Co. of North America	431 Mills Bldg S.F.	May 3, 1920.	Mar. 3, 1920	1000		8,311,855.24 See	note	8,311,855.24 below		Cost-plus-fee Contract	77C
78	Anaconda Copper Mining Co.	Chicago, Ill	Jan. 15, 1923.	Jan. 31, 1923	Jan 2, 1924	Dec 28, 1925	191,559.90		191,559.90	1062	See note below	78
79a	Pelton Water Wheel Co	19th & Harrison Sts., S.F	Apr. 28, 1922	May 5, 1922	Aug. 31, 1923	Apr 20, 1925	247,682.60		247,682.60	1081		79a
[illegible]	Coffin Valve Co.	Monadnock Bldg. S.F	Apr. 28, 1922	May 6, 1922	Feb. 28, 1923	July 2, 1925	36,020.76		36,020.76	1153		[illegible]
80	General Electric Co	Rialto Bldg., S.F.	May 1, 1922	May 11, 1922	Aug 31, 1923	Nov 5, 1924	250,188.60		250,188.60	909		80
Totals							18,184,884.17	+ 130,361.79 - 385,601.99	17,929,643.97			
							Includes payments on uncompleted contracts					

[illegible] ABBREVIATIONS IN COL 3.
[illegible] reservoir and dam
[illegible]
[illegible] Hetchy Railroad
[illegible] Creek Power Plant.

For Sheets 1, 2 and 3 of this table covering Contracts 1 to 60, inclusive, see Annual Report for Fiscal Year 1921-1922.

Note on Contract 77-C: (Cols.18 and 20) Less than figure in 1924-25 report on account of adjustments of accounts and credits for salvage of equipment

Note on Contract 78: The copper transmission line conductor supplied under this contract includes 120 miles of cable for one 3 phase circuit from Newark Substation to S.F

Posted to June 30, 1926

CONTRACT NO.	TITLE OF CONTR		
Col. 1.	Col. 2.		
TOTALS BROUGHT FORW			
81	Furnishing & deliv transformers, swit and accessory equip Moccasin Creek Po		
82	Furnishing, delive and erecting stru steel work for Moccasin Creek Pow		
83	Furnishing & deli dump cars, main duct, Mountain Di		
84	Furnishing & deli air pipe for tunnel ventilat		
85	Construction c Pulgas Tunnel		
86	Furnishing, delive erecting a plate g bridge at Sixbit G the Hetch Hetchy Ro		
87.	Concrete abutm and piers for th Sixbit Gulch Br of the Hetch Het		
88	Grading roadwe the relocation o H.H.R.R. at Sixbit		
89	Furnishing & deli steel reinforce aluminum cable Moccasin Creek Pow		
90	Constructing Bo Crossing Pipe Li H.H. Aqueduct.		
91	Furnishing & del steel penstocks accessories for Moccasin Creek Power		
92	Furnishing, delive and driving of tes across San Franc Bay at Dumbarto		
93	Furnishing, delive erecting steel b superstructure pipe line at Dum		
94	Furnishing, deliv and installing centrifugal ,p		
95	Constructing st structures for bridge across barton Strait.		
96	Construction of treatles for Bo Crossing Pipe		
TOTALS			

CONTRACTS — HETCH HETCHY WATER SUPPLY

[illegible]	[illegible] of contract	Division [illegible]	General Description	Location of work, or location for which material, etc., was purchased		Amount of bond for faithful performance	Date of opening bids	No. of bids	Highest bid	Lowest bid	Successful bid	Contractor	Contractor's address	Date of award	Date of signing contract	Time allowed in days	Date of acceptance	Total payments: Contract items	Total payments: Extras & deductions	Total payments: Total amount paid	[illegible]	Remarks	
	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6.	Col. 7.	Col. 8.	Col. 9.	Col. 10.	Col. 11.	Col. 12.	Col. 13.	Col. 13A.	Col. 14.	Col. 15.	Col. 16.	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21		
	[illegible] forward from sheet 4								$19,223,793.82	$16,806,437.34	$16,832,586.58							$[illegible]	[illegible]	$[illegible]			
[illegible]	[illegible] switchboards [illegible] equipment for [illegible] Power Plant	Moccasin	13-6667 kv-a transformers, 6 station service transformers, switchgear, and instruments.	Moccasin Creek Power Plant.		$135,000.00	Aug. 9, 1922	2	$431,622.00	$379,585.00	$379,585.00	Westinghouse Electric and Manufacturing Co.	East Pittsburgh, Pa. 1st. Nat'l Bank Bldg., S.F.	Aug. 18, 1922	Sept. 13, 1922	352	Sept 2, 1925	379,321.4[illegible]		379,3[illegible]	1085		[illegible]
[illegible]	Furnishing, delivering [illegible] structural steel work for the [illegible] Power Plant	Moccasin	880 000 pounds of structural steel	Moccasin Creek Power Plant.		16,000.00	Feb. 21, 1923		64,240.00	60,720.00	60,720.00	Union Construction and Drydock Co.	Key Route Basin Oakland, Cal.	Feb. 23, 1923	Mar. 10, 1923	127	Jan. 28, 1924	61,408.85		61,408.85	324		[illegible]
[illegible]	Furnishing & delivering dump cars, main aqueduct Mountain Division	Mountain	Ten steel single side dump cars for muck hauling	Mountain Division tunnels		500.00	Mar. 25, 1921	7	3,810.00	3,490.00	3,490.00	Joshua Hendy Iron Works.	75 Fremont St.	Apr 6, 1921	Apr. 9, 1921	76	June 24, 1921	$3,490.00	+ $150.00	$3,640.00	76		83
84	Furnishing & delivering pipe for tunnel ventilation.	Mountain	10374 ft of 24" steel pipe, and 550 cinch bands for same.	Mountain Division tunnels.		2,500.00	Feb. 2, 1921	2	19,298.32	16,726.06	16,726.06	Western Pipe and Steel Co. of California.	444 Market St. S.F.	Feb. 7, 1921	Mar. 18, 1921	120	Jun. 22, 1922	16,726.06	19,257.61	35,983.67	463		84
[illegible]	Construction of the Pulgas Tunnel	Peninsular	Concrete lined tunnel 1.6 miles long and 10'3" in height and width.	Through Pulgas Ridge in San Mateo County near Redwood City.		137,000.00	June 21, 1922	4	779,310.00	683,050.00	683,050.00	Grant Smith and Co.	708 Balboa Bldg S.F.	June 23, 1922	July 5, 1922	500	Aug. 27, 1924	738,429.23		738,429.23	784		85
86	Furnishing, delivering & erecting a plate girder bridge at Sixbit Gulch on the Hetch Hetchy Railroad	H.H.R.R.	Single track plate girder railroad bridge of 9 spans.	Sixbit Gulch [Don Pedro Reservoir]		7,250.00	July 26, 1922	5	37,247.50	26,132.00	26,132.00	Union Construction and Drydock Co.	Key Route Basin Oakland, Cal.	July 28, 1922	Aug. 12, 1922	150	Apr. 10, 1923				241		86
87	Concrete abutments and piers for the Sixbit Gulch Bridge of the Hetch Hetchy R.R.	H.H.R.R.	2 concrete abutments and 8 concrete piers.	Sixbit Gulch [Don Pedro Reservoir]		8,750.00	July 26, 1922	5	44,830.00	32,940.00	32,940.00	Schultz Construction Co.	Geary & Polk Sts. S.F.	July 28, 1922	Aug. 12, 1922	106	Oct. 30, 1922	6,300.00		6,300.00	79	See Note Below	87
88	Grading roadway for the relocation of the H.H.R.R. at Sixbit Gulch	H.H.R.R.	Grading about 1200 ft of single track roadbed	Sixbit Gulch [Don Pedro Reservoir]		2,100.00	July 26, 1922	6	19,660.00	7,900.00	7,900.00	M. J. Lyons.	512-514 Mission St., S.F.	July 28, 1922	July 31, 1922	60	Mar. 16, 1923				228		88
89	Furnishing & delivering steel reinforced aluminum cable for the Moccasin Creek Power Plant	Trans. line.	530 miles of 397000 c.m. cable.	Transmission line from Moccasin Creek P.H. to Irvington.		95,000.00	Jan. 24, 1923	1	374,211.80	374,211.80	374,211.80	Aluminum Company of America,	Pittsburgh, Pa.	Jan. 26, 1923	Feb. 5, 1923	331	Oct. 8, 1924	388,239.68		388,239.68	611		89
90	Constructing Bay Crossing Pipe Line, H.H. Aqueduct	Bay Crossing	5 foot riveted steel pipe line, 19½ miles long, 5/16" to 7/16" plate.	Irvington, Alameda Co. to Pulgas Tunnel.		446,332.25	May 16, 1923	3	3,326,305.00	2,231,661.25	2,231,661.25	Western Pipe and Steel Co. of California.	444 Market St. S.F.	May 18, 1923	June 2, 1923	620	June 16, 1926	2,244,209.42	36000. Bonus 16935.80 Extra -186.37	2,296,958.85	1110		90
91	Furnishing & delivering steel penstocks and accessories for the Moccasin Creek Power Plant.	Moccasin	Penstocks one mile long for 8-12500 H.P. water wheels	Moccasin Creek Power Plant.		42,604.00 203,305.00	May 23, 1923	5	I-274,341.25 II-1,016,525.00	213,016.70 1,016,525.00	213,016.70 1,016,525.00	I.-Western Pipe & Steel Co. II.-M.W. Kellogg Co.	444 Market St, S.F. 90 West St, N.Y.	May 28, 1923	I-June 2, 1923	I-220 II-280	July 9, 1924	211,756.20 1,017,770.47	$21,000.00 (Bonus)	211,756.20 1,038,770.47	403	I = Upper portion. II = Lower portion	91
92	Furnishing, delivering and driving of test piles across San Francisco Bay at Dumbarton Strait.	Bay Crossing	Driving test piles at locations of piers for Dumbarton pipe bridge	Dumbarton Straits		1000.00	May 9, 1923	5	8,939.00	3,811.00	3,811.00	Healy Tibbitts Construction Co.	64 Pine St S.F	May 14, 1923	June 5, 1923	60	June 19, 1923	3,277.20	$ 500.00 (Bonus)	3,777.20	14		92
93	Furnishing, delivering & erecting steel bridge superstructure for pipe line at Dumbarton	Bay Crossing	36-105 ft spans to carry two 6 ft. 4 in. steel pipes	Dumbarton Straits		55,000.00	Aug. 15, 1923	6	324,809.50	272,162.00	272,162.00	U.S. Steel Products Co.	Rialto Bldg., S.F.	Aug. 17, 1923	Sept. 17, 1923	275	Jan 20, 1926	320,912.98	12,000.00 (Bonus)	332,912.98	856		93
94	Furnishing, delivering and installing centrifugal pumps.	Bay Crossing	Two pumps, combined capacity 25 million gallons daily.	Bay-Pulgas pumping plant		2,750.00	Mar. 19, 1924	9	11,500.00	5,125.00	5,125.00	De Laval Steam Turbine Co.	61 Beale St., S.F.	Mar. 31, 1924	Apr. 22, 1924	150	Apr. 24, 1925	5,808.29		5,808.29	367		94
95	Constructing substructures for steel bridge across Dumbarton Strait	Bay Crossing	36 concrete piers and 1 concrete caisson to support bridge furnished under Cont. 93.	Dumbarton Strait.		240,000.00	Oct. 17, 1923	2	1,248,175.00	1,192,483.50	1,192,483.50	Healy Tibbitts Construction Co.	64 Pine St., S.F	Oct. 19, 1923	Nov. 8, 1923	Apr. 1, 1924		1,061,354.38		1,061,354.38			95
96	Construction of timber trestles for Bay Crossing Pipe Line	Bay Crossing	19,300 ft. of 2-pile bent trestle and 4 concrete anchors.	Over marshes between Newark and Bay-Pulgas pumping plant		36,000.00	Apr. 30, 1924	6	194,430.00	167,645.00	167,645.00	Leonard F. Voudoll	Matson Bldg., S.F.	Apr. 30, 1924	May 15, 1924	200	July 14, 1925	189,565.52	2,630.00 (Bonus)	192,195.52	426		96
	Totals								$27,376,108.13	$23,493,681.65	$23,519,770.89							$24,833,513.86 Includes	+238,835.20 -385,788.36 payments uncompleted	$24,686,560.70 on contracts			

Note on Contracts 86, 87, 88: This work made necessary by action of Turlock & Modesto Irrigation Districts in constructing Don Pedro Dam. Actual expenditures under these contracts were: Contr. 86, contract items total $24,630.43. Contr. 87, contract items, $36,374.39, extras $209.17, total $36,583.56. Contr. 88, contract items total $2,597.89. Irrigation Districts paid $57,511.88 of this expense; City paid $6,300.00.

Posted to June 30. 1926

CONTRACT NO.	TITLE OF CONTR
Col 1.	Col. 2.
	TOTALS BROUGHT FORW
97	Furnishing & deliv butterfly valves Moccasin Cr Power
98	Furnishing & deliv electric transm line insulators.
99	Furnishing & deliv electric transmi line towers.
100	Furnishing & deliv gate valves for E Crossing Divisior
101	Furnishing & deliv flexible joint cas pipe.
102	Furnishing & deliv insulating bus sup for Moccasin Pow Plant
103	Furnishing & deliv electric transmis line hardware
104	Furnishing & deli electric motors Bay-Pulgas Pumpin
105	Construction o submarine pip
106	No Contract e
107	Furnishing, deliveri erecting steel bus ture, Moccasin Powe
108	Constr. of wood on portions of Crossing Pipe L
TOTALS	

CONTRACT NO.	TITLE OF CONT
Col 1.	Col. 2.
109	Furnishing and e wrought steel p
110	Making core bor along and near th the H.H. Aqueduc
111	Furnishing and de cableway equip
112	Furnishing and d plow steel co
TOTALS	

1910 WATER CONSTRUCTION FUND

CONTRACTS — HETCH HETCHY WATER SUPPLY

Contract No.	Title of Contract	Division to which chargeable	General Description	Location of work, or location for which material, etc., was purchased		Amount of Bond for Faithful Performance	Date of Opening Bids	No. of Bids	Highest Bid	Lowest Bid	Successful Bid	Contractor	Contractor's Address	Date of Award	Date of Signing Contract	Time Allowed in Days	Date of Acceptance	Total Payments: Contract Items	Total Payments: Extras & Deductions	Total Payments: Amount Paid	Elapsed time	Remarks	Contract No.
[illegible]	Col. 2	Col. 3	Col. 4.	Col. 5.	Col. 6.	Col. 7.	Col. 8.	Col. 9.	Col. 10.	Col. 11.	Col. 12.	Col. 13.	Col. 13A.	Col. 14	Col. 15.	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21	[illegible]	
	[illegible] forward from sheet 5								$27,376,108.19	$23,493,681.05	$23,519,710.89							$24[illegible]	$[illegible]	$[illegible]			
[illegible]	[illegible] & delivering [illegible] valves for [illegible] Power Plant	Mac	Three 104" valves with operating mechanisms & electric motors	Head of Moccasin Creek Penstocks		10,000.00	Jan 3,1924	6	53,900.00	26,728.00	26,728.00	Joshua Hendy Iron Works	75 Fremont St S F	Jan 28,1924	Feb.5,1924	135	June 10,1925	26,728.00		26,728.[illegible]	49		
[illegible]	[illegible] & delivering [illegible] transmission [illegible]	Transm. Line	26000 standard units and 1,500 heavy duty units for 154 kv	Transmission line, Moccasin P.H. to Newark		50,000.00	Dec 9,1923	5	120,710.00	89,407.50	89,407.50	Westinghouse Electric & Manufacturing Co	1st. Nat'l Bank Bldg, S.F	Dec 21,1923	Jan. 4, 1924	To July 15 1924	May 20,1925	90,750.66		90,750.66	50		
[illegible]	[illegible] & delivering electric transmission line towers	Transm Line	About 510 double circuit towers	Do		125,000.00	Jan.9,1924	2	392,878.00	274,224.00	274,224.00	Pacific Coast Steel Co.	Rialto Bldg., S.F	Jan. 11,1924	Jan 25,1924	To July 1, 1924	Aug 14 1925	300,513.99		300,513.39	568		
[illegible]	[illegible] & delivering [illegible] valves for Bay Crossing Division	Bay Crossing	2-42", 1-36" and 4-20" gate valves	Bay Crossing Pipe Line and Bay-Pulgas Pump Station		9,167.50	Feb 20,1924	2	21,282.00	18,335.00	18,335.00	Union Machine Co.	934 Brannan St. S F	Mar 5,1924	Mar 18,1924	120		18,172.62		18,172.62			
[illegible]	[illegible] & delivering [illegible] joint cast iron pipe	Bay Crossing	1618 tons flexible joint C I pipe for submarine siphons	Dumbarton Strait and Newark Slough		59,500.00	Feb 20,1924	3	272,824.25	196,802.00	196,802.00	U.S Cast Iron Pipe and Foundry Co	Burlington, N J.	Mar 10,1924	Mar 20,1924	To Sept 20 1924	Aug 24,1925	208,496.98		208,496.98	522		
102	Furnishing & delivering insulating bus supports for Moccasin Power Plant	Mac	Post insulators for outdoor switching station	Moccasin Power Plant		4,400.00	Mar.19,1924	9	* 24,952.05	* 15,435.56	* 15,674.10	Ohio Brass Co. Delta-Star Electric Co.	Hobart Bldg., S F 123-2nd St., S F	Mar 26,1924	Apr 9,1924 Apr 10,1924	To Sept 1 1924	Nov. 26,1924 Feb. 18,1925	12,937.50 2,648.25		12,937.50 2,648.25	231 314	* Sum of bids on 3 [illegible]	
103	Furnishing & delivering electric transmission line hardware	Transm. line	Hooks and clamps for insulators and cable	Transmission line M.C.P.H. to Newark		2,900.00	Apr. 2,1924	5	* 12,916.81	* 12,410.11	* 12,469.61	Westinghouse El. & Mfg. Co. Western Electric Co.	1st Nat Bank Bldg, S.F 680 Folsom St. S.F	Apr 11,1924	Apr. 24,1924 Apr 29,1924	To Aug. 1 1924	Mar 27,1925 Dec. 15,1924	7,739.58 4,897.80		7,739.58 4,897.80	337 230	* Sum of bids on 5 items	
104	Furnishing & delivering electric motors for Bay-Pulgas Pumping Plant	Bay Crossing	Two 500 HP induction motors and starting apparatus	Bay-Pulgas Pump Station		1,500.00	Apr. 30,1924	3	7,754.00	6,790.00	6,790.00	General Electric Co.	Rialto Bldg	May 7,1924	May 22,1924	130	Apr. 24,1925	6,790.00		6,790.00	337		[illegible]
105	Construction of submarine pipe lines	Bay Crossing	Laying pipe furnished under Contract 101	Dumbarton Strait and Newark Slough		68,646.00	Aug.20,1924	3	489,691.80	343,230.00	343,230.00	Healy-Tibbitts Construction Co.	64 Pine St S.F	Aug.22,1924	Oct 15,1924	180		280,046.59		280,046.59			[illegible]
106	No Contract entered into.																						106
107	Furnishing, delivering and erecting steel bus structure Moccasin Power Plant	Moc.	Moccasin Power Plant Bus Structure	Moccasin Power Plant		7,500.00	Nov. 5,1924	4	40,716.00	29,640.00	29,640.00	California Steel Co.	Hobart Bldg. S.F	Nov. 6,1924	Nov 19,1924	85	June 15,1925	30,314.79		30,314.79	208		107
108	Const. of wood cover or portions of Bay Crossing Pipe Line	Bay Crossing	Cover over 5 foot pipe on trestle	Newark to Ravenswood, over marsh land		3,441.00	Jan.21,1925	5	44,996.40	17,205.00	17,205.00	J. W. Carpenter	358 Tennyson Ave Palo Alto, Calif.	Jan.23,1925	Feb.3,1925	90	Aug 24,1925	16,765.77		16,765.77	202		108
TOTALS									$28,858,729.50	$24,523,888.82	$24,550,276.10							$25,840,316.39	$+238,835.20 −385,788.36	$25,393,363.23			

1925 WATER CONSTRUCTION FUND

CONTRACTS — HETCH HETCHY WATER SUPPLY

SHEET 7

Contract No.	Title of Contract	Division to which chargeable	General Description	Location of work, or location for which material, etc., was purchased		Amount of Bond for Faithful Performance	Date of Opening Bids	No. of Bids	Highest Bid	Lowest Bid	Successful Bid	Contractor	Contractor's Address	Date of Award	Date of Signing Contract	Time Allowed in Days	Date of Acceptance	Total Payments: Contract Items	Total Payments: Extras & Deductions	Total Payments: Amount Paid	Elapsed Time from Signing to Acceptance, Days	Remarks	Contract No.
Col. 1	Col. 2	Col. 3	Col. 4.	Col. 5.	Col. 6.	Col. 7.	Col. 8.	Col. 9.	Col. 10.	Col. 11.	Col. 12.	Col. 13.	Col. 13A.	Col. 14	Col. 15.	Col. 16	Col. 17	Col. 18	Col. 19	Col. 20	Col. 21	Col. 22	[illegible]
[illegible]	Furnishing and delivering wrought steel pipe	Foothill	Water supply pipe line for tunnel construction camps	Moccasin to Oakdale Portal. Pipe follows H.H.R.R. and tunnel location		$10,000.00	Oct 28,1925	7	$47,864.35	$44,432.25	$44,432.25	Republic Supply Co.	670-2nd St. San Francisco	Oct.31,1925	Nov.4,1925	Delivery as ordered	Feb.17,1926	$45,263.09		$45,263.09	105		[illegible]
[illegible]	Making core borings along and near the line of the HH Aqueduct	Coast Range	Core borings made to determine best location for HH Aqueduct tunnels	From Tesla Portal to Irvington Gate House		10,000.00	Jan 20,1926	4	26,624.00	18,884.00	18,884.00	International Diamond Drill Contracting Co	501 Hobart Bldg San Francisco	Jan 22,1926	Feb.18,1926	100		8,887.61		8,887.6[illegible]			
[illegible]	[illegible] and delivering [illegible] equipment	Foothill	Cableway equipment	Red Mountain Bar on Tuolumne River		50% of bid price	Jan 27,1926	3	30,775.00	29,975.00	None											All bids rejected on Feb 13,1926	
[illegible]	[illegible] and delivering [illegible] cable	Foothill	Track cable for Lidgerwood cableway	Red Mountain Bar on Tuolumne River		1,600.00	Mar.3,1926	8	5,350.50	3,132.00	3,132.00	E.H.Edwards Co.	225 Bush St. San Francisco	Mar.10,1926	Mar 19,1926	60		2,322.54		2,322.54			
[illegible]																		$56,473.24		$[illegible]			

Posted to June 30 [illegible]

EXPENDITURES ON HETCH HETCHY PROJECT
June 30, 1926

1909 and 1910 Bond Funds Together with Amount Advanced from General Fund Prior to Bond Issues

(Due to adjustments, the sum of reports for previous years does not correspond to the totals as of June 30, 1926)

Acct. No.	Primary Accounts	Fiscal Year 1925-1926	Total to June 30, 1926
	Water Construction		
	General Expenditures		
2001	Preliminary Water Supply Investigations	$ 4.75*	$ 140,408.29
2002	Lands, Water Rights and Rights of Way	12,841.29	1,741,126.49
2003	Rentals to U. S. Government		106,018.11
2004	Legal Expense	1,518.45	179,818.03
2005	Hydrography	627.60	63,879.95
2006	City Office Administration	9,084.61	446,677.55
2007	City Office Engineering	14,460.76	399,543.26
2008	State Compensation Insurance	4,803.70	4,680.67
2009	Taxes	6,568.98	55,759.58
2010	Miscellaneous Construction Expenditures	19,511.00*	15,171.42
2012	Unamortized Expense, sale of bonds		26,877.36
2013	Hetch Hetchy Lodge (Mather)	295.99	
2014	San Francisco Municipal Camp (Mather)	509.92	
2101	Groveland Office Administration and Engineering	3,170.33	256,716.17
2102	Groveland Hospital Buildings and Equipment	4,550.00*	67,524.74
2104	Groveland Hosp. Revenue Less Operat. Expenses	6,313.56	193,177.50*
2110	Groveland Employees Dwellings	335.61*	68,458.47
2111	Groveland Warehouse		9,725.96
2112	Groveland Permanent Water Supply	806.20*	33,783.85
2124	Groveland Stable and Garage Equipment	33,442.47*	
	TOTAL	1,545.16	3,422,992.40
	Hetch Hetchy Division		
2201	Preliminary Investigations and Surveys		208,685.18
2202	Engineering and Inspection		244,176.01
2203	Camps		139,395.75
2204	Roads, Trails and Tramways		190,256.49
2205	Dam and Appurtenances, City Forces	3,039.27*	421,879.48
2205	Dam and Appurtenances, Contract 61		6,170,807.46
2206	Clearing Reservoir		183,712.14
2208	Dam and Appurt., Gates and Valves Contract		595,616.64
2226	Telephone Lines	.68	4,737.73
2227	Camp Maintenance		2,128.59
	TOTAL	3,038.59*	8,161,395.47

Note—Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1926
1909 and 1910 Bond Funds and General Fund

Acct. No.	Primary Accounts	Fiscal Year 1925-1926	Total to June 30, 1926
	Water Construction (Con't)		
	Mountain Division—Tunnel Construction		
2401	Preliminary Investigations and Surveys		156,726.14
2402	Engineering and Inspection	44.29*	221,168.22
2403	Camps	970.99*	26,450.68
2404	Roads, Trails and Tramways	104.58	219,155.14
2405	Adits	133.56	2,080.09
2406	Shafts	5,337.77*	181,317.06
2407	Tunnels, City Forces	123,587.63	1,438,797.29
2407	Tunnels, Contract 77-C	191,810.90*	8,311,855.24
2409	South Fork Crossing, Excavation	391.33	13,025.71
2410	South Fork Crossing, Concrete Piers	68.58*	5,406.67
2411	South Fork Crossing, Piping and Valves	1,668.29	55,855.87
2426	Telephone Lines	176.21	15,474.72
2427	Camp Maintenance		7,723.28
	TOTAL	72,170.93*	10,655,036.11
	Foothill Division		
2701	Preliminary Investigations and Surveys	$ 4,087.71*	$ 2,954.57
2704	Roads, Trails and Tramways	471.38*	
2708	Tuolumne River Crossing	771.64*	282,468.38
2726	Telephone Lines	40.00*	
	TOTAL	5,370.73*	285,422.95
	Early Intake Diversion Works		
2901	Preliminary Investigations and Surveys		6,890.54
2902	Engineering and Inspection	.55	16,978.55
2903	Camps	1,595.18	19,176.78
2904	Roads, Trails and Tramways	799.14*	27,810.21
2905	Dam and Appurtenances	30,622.52*	284,259.61
2906	Spillway and Appurtenances	18,890.58	217,209.84
2907	Diversion Tunnel	4,925.41*	287,977.92
2908	Diversion Canal	496.47	17,768.65
2926	Telephone Lines	.77	121.43
2927	Camp Maintenance	12.87	6,028.52
	TOTAL	15,350.65*	884,222.05

Note—Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1926
1909 and 1910 Bond Funds and General Fund

Acct. No.	Primary Accounts	Fiscal Year 1925-1926	Total to June 30, 1926
	Water Construction (Con't)		
	Canyon Ranch and Mather Sawmill		
3002	Engineering and Inspection		24.21
3003	Camps		28,074.67
3004	Roads, Trails and Tramways		2,873.67
3005	Sawmill and Equipment	10.00*	28,641.40
3006	Stumpage Rights and Land		5,103.82
3026	Telephone Lines	.67	27.96
3027	Camp Maintenance		3,983.88
3070	Operation Net (Op. Exp. less lumber delays)	1,062.78*	86,329.20
	TOTAL	1,072.11*	155,058.81
	Munn Sand Plant		
3170	Operating Expenses—Total	15.00	15.00
	San Joaquin Division		
3302	Engineering and Inspection		11.95
3305	Lands and Rights of Way	37.61*	211,637.41
	TOTAL	37.61*	211,649.36
	Coast Range Division		
3401	Preliminary Investigations and Surveys—Total		30.00
	Golden Rock Ditch		
3501	Operating Expenses, less Water Sales—Total		6,561.99
	Boarding House and Commissary Expenses		
4000	Boarding Houses, City Forces, Net Operation	$ 5,157.97*	$ 303,160.22
4500	Commissary Supplies	3,470.26*	1,881.72
4510	Commissary Supply Expenses	9,160.39	463.50*
	TOTAL	532.16	304,578.44
	Materials and Supplies		
5000 5010	Materials and Supplies Materials and Supplies Expense } Total	318,609.40	232,336.21
	Bay Development		
6001	General Engineering	5,369.11	24,750.98
6002	Lands and Rights of Way	3,864.68	220,316.67
6007	City Office Administration and Engineering	8,979.44	51,001.26
6009	Taxes	1,602.88	2,775.64
6101	Newark Section—Prelim. Invest. and Surveys		407.30
6102	Newark Section—Engineering	43.25	8,541.86
6107	Newark Sec.—Trestle for Pipe Line (Cont. 96)	191.36	199,176.34

Note—Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1926
1909 and 1910 Bond Funds and General Fund

Acct. No.	Primary Accounts	Fiscal Year 1925-1926	Total to June 30, 1926
	Water Construction		
	Bay Development—(Con't).		
6201	Ravenswood Sec.—Prelim. Invest. and Surveys		771.36
6202	Ravenswood Sec.—Engineering	6,804.44	23,666.14
6207	Ravenswood Sec.—Sub. and Superstructure across Dumbarton Straits (Contract 93 and 95)	356,642.44	1,414,086.31
6208	Ravenswood Sec.—Flexible Pipe Line Construction (Contract 101 and 105)	283,235.13	517,341.23
6301	Redwood Sec.—Prelim. Invest. and Surveys		4,501.72
6302	Redwood Sec.—Engineering	134.10	9,658.89
6307	Redwood Sec.—Pipe Line Bay Cross. (Cont. 90)	149,970.99	2,431,582.51
6308	Redwood Sec.—Gate Valves (Cont. 100)	651.75	18,773.37
6309	Redwood Sec.—Pump Plant Elect. Motors (Contracts 94, 104)	533.53	17,480.06
6310	Redwood Sec.—Pump Plant Buildings	182.66	7,850.85
6401	Peninsula Sec.—Prelim. Invest. and Surveys		3,887.53
6402	Peninsula Sec.—Engineering		24,864.54
6407	Peninsula Sec.—Pulgas Tunnel Const. (Cont. 85)		757,315.68
	TOTAL	818,205.76	5,738,750.24
	Miscellaneous		
	City Engineer's Revolving Fund		20,000.00
	San Francisco-San Mateo Water Supply Investigation	3,000.00	3,000.00
	Field Collections in transit, as of June 30, 1926	1,418.35	1,418.35
	Miscellaneous Accounts Receivable	13,191.45	13,191.45
	TOTAL	17,609.80	37,609.80
	TOTAL EXPENDITURES WATER CONSTRUCTION	$1,059,476.66	$30,095,643.83
	Power Construction		
	Lake Eleanor Division		
2301	Preliminary Investigation and Surveys	$	$ 3,937.83
2302	Engineering and Inspection		267.11
2303	Camps		3,151.61
2304	Roads, Trails and Tramways	12.00*	21,325.53
2305	Dam and Appurtenances		299,876.37
2306	Clearing Reservoir		62,255.97
2326	Telephone Lines		717.24
2327	Camp Maintenance		662.84
	TOTAL	12.00*	392,194.50

Note—Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1926
1909 and 1910 Bond Funds and General Fund

Acct. No.	Primary Accounts	Fiscal Year 1925-1926	Total to June 30, 1926
	Power Construction (Con't)		
	Priest Division		
2501	Preliminary Investigations and Surveys		49.51
2502	Engineering and Inspection	130.03	40,411.68
2503	Camps	24,401.49*	24,584.20
2504	Roads, Trails and Tramways	8,871.54*	8,460.11
2505	Dam and Appurtenances	49,345.28	900,380.59
2506	Clearing Reservoir	42.98	6,321.14
2507	Outlet or Power Tunnel	57,034.99*	1,297,194.32
2508	Diversion Tunnel	10,520.82	109,266.49
2526	Telephone Lines	4.46	255.46
2527	Camp Maintenance	4,704.83*	4,409.35
	TOTAL	34,969.28*	2,391,332.85
	Moccasin Division		
2601	Preliminary Investigations and Surveys		2,797.11
2602	Engineering and Inspection	1,235.48	77,094.19
2603	Camps	39,727.13	397,285.66
2604	Roads, Trails and Tramways	11,732.95*	100,392.33
2605	Lands and Rights of Way		16,024.93
2606	Penstock (Contract 91A and G)	96,714.95	2,283,282.89
2607	Power Plant Bldgs. and Structures (Cont. 85)	33,452.57	686,384.69
2608	Power Plant Hydraulic Equip. (Conts. 79, 79A)	23,052.75	388,135.59
2609	Power Plant Electrical Equip. (Conts. 80, 81A)	46,677.43	886,131.70
2626	Telephone Lines	249.40	1,346.38
2627	Camp Maintenance	5,321.34	27,455.03
2628	General Equipment	28,398.91*	20,940.94
2691	Concrete Storage Plant	29,420.66*	
2692	Stable and Garage Expense	29,202.80*	
2693	Locomotive Crane Expense	5,073.92*	2,094.82*
2695	Machine Shop Expense	19,455.03*	
2696	Carpenter Shop Expense	1,006.20*	
2697	Blacksmith Shop Expense	3,168.24*	
2698	Materials and Supplies	9,093.75*	17,692.79
2699	Supply Expense	25,921.95	13,330.89*
2670	Power House Operations	1,264.28	22,580.13
	TOTAL	137,064.82	4,912,118.65

Note—Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1926
1909 and 1910 Bond Funds and General Fund

Acct. No.	Primary Accounts	Fiscal Year 1925-1926	Total to June 30, 1926
	Power Construction (Con't)		
	Lower Cherry Power Development		
2802	Engineering and Inspection		$ 4,966.02
2803	Camps	1,143.54*	449.58
2804	Roads, Trails and Tramways	32.77	1,053.06
2805	Lands Devoted to Electrical Operations		1,419.20
2806-7-8-13	Penstocks, Power Plant Buildings, Hydraulic Equipment and Miscellaneous Equipment		443,346.81
2814 to 2822	Transmission Line Construction	9,005.28*	219,034.69
2826-2827	Telephone Lines, Camp Maintenance		
2870-2840	Power House Operations Net (Operating Expenses less Revenue)	24,468.25*	376,915.62*
	TOTAL	34,584.30*	293,353.74
	Power Transmission System		
3201	Preliminary Investigations and Surveys	122.75*	10,574.09
3202	Engineering	439.29	93,074.18
3203	Camps	458.83*	52,850.40
3204	Roads, Trails and Tramways	62.73*	28,696.67
3205	Lands and Rights of Way	3,558.05	122,622.62
3209	Materials and Supplies	295.94*	220.37
3213	Miscellaneous Electrical Equipment	11,581.88*	
3214	Towers and Fixtures (Contract 99)	40,610.00	671,107.73
3215	Overhead System (Contracts 78, 89, 98, 103)	40,142.96	787,338.68
3216	Clearing	679.85	12,721.37
3220	Transformers and Devices	1.89	14,703.28
	TOTAL	72,909.91	1,793,909.39
	Miscellaneous		
	(See note, page 82.)		
	Calif. R. R. Commission Evaluation, P. G. & E. and G. W. P. Plants—Total	12,984.45	247,303.68
	TOTAL EXPENDITURES POWER CONSTRUCTION	153,393.60	10,030,212.81

Note—Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1926
1909 and 1910 Bond Funds and General Fund

Acct. No.	Primary Accounts	Fiscal Year 1925-1926	Total to June 30, 1926
	Hetch Hetchy Railroad		
	Investment Accounts, Additions and Betterments, Materials and Supplies	$ 60,875.95*	$ 2,753,483.25
	Operation Net (Operating Expenses, less Revenues)	1,010.56	69,930.41
	TOTAL EXPENDITURES HETCH HETCHY RAILROAD	59,865.39*	2,823,413.66
	Revenues (not included in foregoing)		
	Crocker-Amazon and San Miguel Tract Rentals and Mather (Yosemite National Park and Standard Oil Company Rentals	$ 2,727.07	$ 18,899.77
	Use of Pipe Line, Bay Development	24,600.78	24,600.78
	Sale of Water to Irrigation Districts	47,229.17	164,979.17
	Miscellaneous Receipts		3,643.68
	TOTAL MISCELLANEOUS REVENUES	74,557.02	212,123.40
	Summary of Expenditures and Revenues		
	Expenditures		
	Water Construction	$1,059,476.66	$30,095,643.83
	Power Construction	153,393.60	10,030,212.81
	Hetch Hetchy Railroad	59,865,39*	2,823,413.66
	TOTAL GROSS EXPENDITURES	1,153,004.87	42,949,270.30
	Revenues		
	TOTAL	74,557.02	212,123.40
	TOTAL NET EXPENDITURES	$1,078,447.85	$42,737,146.90
	In the foregoing expenditures is included an amount due the 1925 Fund for Materials and Supplies transferred and services rendered. This item is treated as a current liability in the 1910 Fund and is offset by a current receivable in the 1925 Fund	$ 4,643.23*	$ 4,643.23*

Note—Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1926
1909 and 1910 Bond Funds and General Fund
Reconciliation of Statement of Expenditures with Consolidated Statement of Funds

Disbursements as per Consolidated Statement of Funds:			
1909 Bond Issue		$ 603,033.87	
1910 Bond Issue		42,715,096.41	
General Fund		118,219.93	
Hetch Hetchy Operative Revenue Fund	$1,855,884.72		
Transfer to Bond Interest Fund	620,000.00*	1,235,884.72	$44,672,234.93
Receipts Used as Reduction of Expenditures, viz:			
Operation Hetch Hetchy Railroad	1,354,085.72		
Sale of Power, Lower Cherry Power Division	386,338.54		
Sale of Water, Golden Rock Ditch	1,017.88		
Sale of Water to Irrigation Districts	164,979.17		
Use of Pipe Line, Spring V. Water Co.	24,600.78		
Miscellaneous	5,065.49	1,936,087.58	
Non-cash credits used as reduction of expenditures, but not appearing on Statement of Funds		3,643.68	1,939,731.26
TOTAL			$42,732,503.67
Non-cash debits included in expenditures but not appearing on Statement of Funds:			4,643.23
NET EXPENDITURES AS PER DETAILED STATEMENT (Page 81)			$42,737,146.90
For comparison with net expenditures of previous years deduct from net expenditures above the amount of $247,303.68 which was paid out of Hetch Hetchy Operative Revenue Fund for valuation of Pacific Gas and Electric Company's and Great Western Power Company's plants. This charge is not a true Hetch Hetchy Water Supply Project expenditure.			
NET EXPENDITURES AFTER MAKING SUCH DEDUCTION			$42,489,843.22

Note—Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1926
1925 Bond Fund

Acct. No.	Primary Accounts	Fiscal Year 1925-1926	Total to June 30, 1926
	Water Construction		
	Foothill Division		
2700	Division Administration and Engineering	$ 35,876.96	$ 35,876.96
2701	Preliminary Investigations and Surveys	31,461.07	34,465.39
2702	Field Engineering and Inspection	10,574.89	10,574.89
2703	Camps	274,516.10	274,516.10
2704	Roads, Trails and Tramways	89,046.64	89,046.64
2705	Adits	45,952.30	45,952.30
2706	Shafts	52,566.77	52,566.77
2707	Tunnels	229,744.84	229,744.84
2714	Miscellaneous Jobbing and Sales Accounts	2,213.44	2,213.44
2716	Division Machine Shops (includes Operation)	32,379.07	32,379.07
2717	Division Warehouse (includes Operation)	32,049.30	32,049.30
2718	Lands and Rights of Way	34,863.20	34,863.20
2719	Power Transmission Line for Const. Purposes	37,333.52	37,333.52
2720	Division Administration Building and Equipment	50,607.70	50,607.70
2721	Division Hospital (includes Operation)	6,684.05	6,684.05
2722	Materials and Supplies	221,582.57*	371,657.43
2723	Division Miscellaneous Shops and Equipment (including Operation)	43,833.72	43,833.72
2724	Division Garage Equipment (inc. Operation)	36,050.80	36,050.80
2726	Division Communication System	13,719.18	13,719.18
2727	Camp Operation (includes Boarding Houses)	18,186.09	18,186.09
2792	General Administration	26,838.07	26,838.07
2793	General Engineering	18,016.37	18,016.37
2794	Law Expenses during Construction	5,328.63	5,328.63
2797	Miscellaneous Construction Expenditures	172.46	172.46
	Electric Energy from Hetch Hetchy Plants	3,513.46*	3,513.46*
	TOTAL	902,919.14	1,499,163.46
	Coast Range Division		
3401	Preliminary Investigations and Surveys	17,804.82	17,804.82
3492	General Administration	217.57	217.57
3493	General Engineering	980.62	980.62
3494	Law Expenses during Construction	7.50	7.50
	TOTAL	19,010.51	19,010.51

Note—Asterisk (*) denotes credit.

Expenditures on Hetch Hetchy Project
June 30, 1926
1925 Bond Fund

Acct. No.	Primary Accounts	Fiscal Year 1925-1926	Total to June 30, 1926
	Water Construction (Con't)		
	General and Miscellaneous		
2790	Unamortized Expense on Securities Sold	272.50	4,439.50
	Accounts Receivable, Hetch Hetchy Power Operative Fund		7,796.32
	Accounts Receivable, 1910 Water Construct. Fund		4,643.23
	TOTAL	272.50	16,879.05
	TOTAL NET EXPENDITURES	922,202.15	1,535,053.02

Reconciliation of Statement of Expenditures with Statement of Funds

	Disbursements as per Statement of Funds		
DISBURSEMENTS AS PER STATEMENT OF FUNDS			$ 1,533,087.03
Vouchers taken into expenditures in month of June, which vouchers are not taken up by City and County Auditor until July		$ 9,772.80	
Non-cash debits included in expenditures but not appearing on Statement of Funds		10,582.16	
TOTAL		20,354.96	
Cash receipts included in expenditures—As of June 30, 1926, which receipts are not taken up by City and County Auditor until July	$18,388.47		
Error in Payroll for June adjusted in July	.50	18,388.97	1,965.99
NET EXPENDITURES AS PER DETAILED STATEMENT (above)			$ 1,535.053.02

Hetch Hetchy Operative Revenue Fund

TOTAL			$ 1,960,829.25
Transferred to Bond Interest Fund		$ 620,000.00	
Transferred to P. G. & E. and G. W. P. Co.'s Evaluation		247,303.68	
Transferred to Water Supply Investigation, San Mateo County		3,000.00	
Transferred to Hetch Hetchy 1910 Fund		982,111.67	
Transferred to Hetch Hetchy Power Operative Fund		3,469.37	1,855,884.72
BALANCE AVAILABLE, JUNE 30, 1926			$ 104,944.53

Expenditures on Hetch Hetchy Project
June 30, 1926

Hetch Hetchy Power Operative Fund

Condensed Balance Sheet

Assets and Other Debits

Fixed Capital for Service	$25,388,347.30
Current and Accrued Assets	1,256,922.07
Special Funds (Sinking and Depreciation Funds)	264,655.22
Deferred Debits	1,508,449.73
TOTAL ASSETS AND OTHER DEBITS	$28,418,374.32

Liabilities and Other Credits

Capital and Long Term Debt			$26,946,333.23
Current and Accrued Liabilities			466,412.36
Reserves (for Depreciation)			61,456.10
Appropriated Surplus (Sinking Fund, Retirement 1910 Bonds)			512,100.00
Unappropriated Surplus			432,072.63
Balance as per Income Statement		$ 314,443.12	
Add: Taxes for Comparison Purposes	$ 121,375.55		
Deduct: Revenues Charged City and County of San Francisco (H. H. W. S. Construction)	3,746.04	117,629.51	
TOTAL LIABILITIES AND OTHER CREDITS			28,418,374.32

Income Statement

(For 10½ months—since commencement of operation, August 14, 1925)

Income from Operating Properties

Operating Revenues:		
Moccasin Creek Power House	$7,403,693.40	
Early Intake Power House	48,699.70	$ 7,452,393.10
Operating Expense:		
Production	116,141.39	
Transmission	11,820.35	
Distribution	83.44	
Commercial Department	5,408,913.66	
General and Miscellaneous	111,763.50	5,648,722.34
TOTAL		1,803,670.76
Deduct Taxes Assignable to Operations		556.35
NET OPERATING INCOME (GROSS INCOME)		1,803,114.41

Deductions from Gross Income

Interest on Long-term Debt	$ 788,854.50	
Miscellaneous Interest Deductions	15,979.22	
Amortization of Bond Discount and Expense	54,108.06	858,941.78
NET INCOME		944,172.63

Expenditures on Hetch Hetchy Project
June 30, 1926
Hetch Hetchy Power Operative Fund
Income Statement—(Con't.)

Disposition of Net Income

Net Income	$944,172.63
Sinking Fund Appropriations (Retirement 1910 Bonds)	512,100.00
Balance for Actual Surplus	432,072.63
Add: For Revenues charged City and County of San Francisco (Hetch Hetchy Water Supply Construction Purposes)	3,746.04
Total	435,818.67
Deduct: Estimate of Taxes for Comparison Purposes	121,375.55
Balance After Adjustment	$ 314,443.12

Addenda

Interest Received on Bay Development Expenditures

	Principal	Interest
April 18, 1922, to May 31, 1924		$ 58,232.05
June 1, 1924, to April 17, 1925	$4,796,086.43	170,451.54
Transferred to 1910 Bond Interest Fund		228,683.59
July 1, 1925, to June 30, 1929	5,000,000.00	
Transferred to 1910 Bond Fund		883,390.64

Interest Received on Accounts Receivable and Surplus Funds Invested

July 1, 1919, to June 30, 1926 (1910 Bond Fund) Credited to 1910 Bond Interest Fund		2,910,471.16
November 1, 1918, to June 30, 1924 (Hetch Hetchy Operative Revenue Fund) Accounts Receivable, Hetch Hetchy Railroad	19,006.67	
Surplus Funds	5,735.00	
Credited to Hetch Hetchy Operative Revenue Fund		24,741.67

Receipts from Water Crop

Waterford Irrigation District	750.00
Turlock Irrigation District	90,000.00
Modesto Irrigation District	74,229.17
Total	164,979.17
Sales from Golden Rock Ditch	1,017.88
Credited to Hetch Hetchy Operative Revenue Fund	$ 165,997.05

Receipts from Use of Pipe Line—Bay Development

September to December, 1925—Credited to Hetch Hetchy Operative Revenue Fund	24,600.78

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HETCH HETCHY PROJECT

Consolidated Statement of Funds - June 30, 1926.

	Bond Issues			General Fund	H.H. Operative Revenue Fund	H.H. Power Operative Fund	Totals
	1909	1910	1925				
RECEIPTS:	$	$	$	$	$	$	$
Par Value of Bonds Sold	600,000.00	45,000,000.00	2,000,000.00				47,600,000.00
Premiums, Sale of Bonds	3,050.00	11,348.00	107,211.00				121,609.00
Discount, Sale of Bonds		2,980,326.55 D					2,980,326.55 D
Net Proceeds, Sale of Bonds	603,050.00	42,031,021.45	2,107,211.00				44,741,282.45
Advanced from General Fund				118,151.02			118,151.02
Interest Earned on Funds Invested					5,735.00		5,735.00
Interest Earned on Accts. Receivable					19,006.67		19,006.67
Advance Payments by Spring Valley Water Company		883,390.64					883,390.64
Operation of Hetch Hetchy Railroad					1,354,085.72		1,354,085.72
Sale of Power, Lower Cherry Power Division					386,338.54		386,338.54
Sale of Water from Golden Rock Ditch					1,017.88		
Sale of Water to Irrigation Districts					164,979.17		165,997.05
Use of Pipe Line, Bay Development					24,600.78		24,600.78
Miscellaneous					5,065.49		5,065.49
Operating Revenues						1,835,214.83	1,835,214.83
Transfers	16.13 D	52.78 D		68.91			
Total Receipts	603,033.87	42,914,359.31	2,107,211.00	118,219.93	1,960,829.25	1,835,214.83	49,538,868.19
DISBURSEMENTS:							
Construction of Project and Operation of Railroad and Power Plants	603,033.87	43,697,208.08	1,533,087.03	118,219.93	3,000.00		45,954,548.91
For Hetch Hetchy Power Operative Fund Legal Expense					3,469.37		3,469.37
For Cal. R.R. Commission Evaluation) P. G. & E. and G. W. P. Plants					247,303.68	See note, page	247,303.68
For Bond Interest (Transferred to Bond Interest Fund)					620,000.00		620,000.00
Transferred to 1910 Fund:		982,111.67 C			982,111.67		
Operating Expenses						186,650.61	186,650.61
Transferred to Bond Interest Fund						354,919.36	354,919.36
Transferred to Bond Redemption Fund						203,199.12	203,199.12
Total Disbursements	603,033.87	42,715,096.41	1,533,087.03	118,219.93	1,855,884.72	744,769.09	47,570,091.05
Cash Balance June 30, 1926		199,262.90	574,123.97		104,944.53	1,090,445.74	1,968,777.14
RESERVED FOR:							
Contract Liability		215,312.53*	8,318.66				223,631.19
Purchase Orders and Audited Vouchers Payable		1,770.43	85,954.16			40,861.38	128,585.97
Depreciation						61,456.10	61,456.10
Total Reserved		217,082.96	94,272.82			102,317.48	413,673.26
Available Balances, June 30, 1926		(Deficit (17,820.06*	479,851.15		104,944.53	988,128.26	1,555,103.88

(The letter "C" after figures denotes credit)
(The letter "D" after figures denotes deduction)

* Amount reserved was to cover all possible payments that might be made. Final payments amounted to only $194,605.12, leaving an actual Cash Balance of $2,887.35 instead of the deficit of $17,820.06 shown.

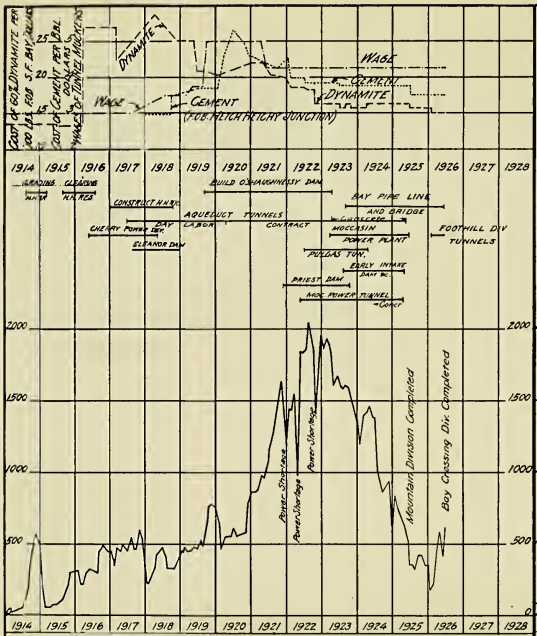
CONTRACTUAL LIABILITIES, HETCH HETCHY WATER SUPPLY PROJECT

1910 Bond Fund

Cont. No.	Contractor	Object of Expenditure	Amount of Contract	Amount Due June 30, 1926
95	Healy Tibbitts Construction Company	Substructure Steel Bridge	$1,250,000.00	$137,129.12
105	Healy Tibbitts Construction Company	Submarine Pipe Line	360,000.00	78,183.41
	TOTAL			215,312.53
	Actual payments made as final settlement—No. 95		120,045.84	
	No. 105		74,559.28	194,605.12
	RELEASED TO BOND FUND			20,707.41

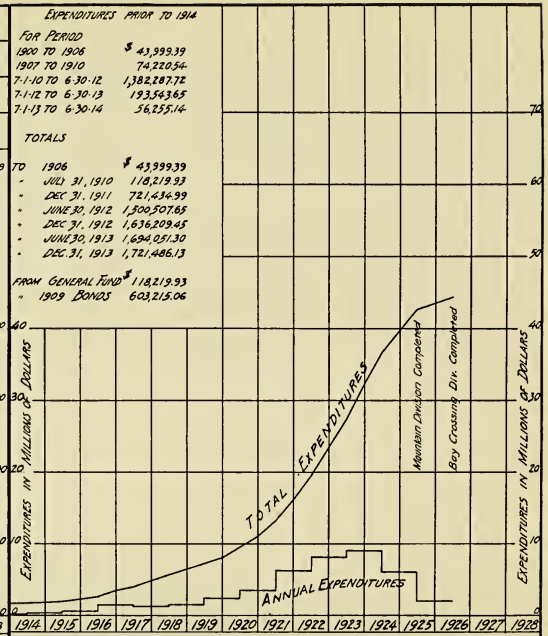
1925 Bond Fund

110	International Diamond Drill Contracting Co.	Core Borings, Aqueduct, Coast Range	18,884.00	7,509.20
112	E. H. Edwards Co.	Plow Steel Cable, Foothill Division	3,132.00	809.46
	TOTAL		22,016.00	8,318.66
	Actual expenditures and final settlements—No. 110		21,016.55	9,641.75
	No. 112		2,732.40	409.86
	TOTAL		$ 23,748.95	10,051.61
	ADDITIONAL CHARGE TO BOND FUND			$ 1,732.95



EXPENDITURES PRIOR TO 1914

FOR PERIOD	
1900 TO 1906	$ 43,999.39
1907 TO 1910	74,220.54
7-1-10 TO 6-30-12	1,382,287.72
7-1-12 TO 6-30-13	193,543.65
7-1-13 TO 6-30-14	56,255.14
TOTALS	
TO 1906	$ 43,999.39
" JULY 31, 1910	118,219.93
" DEC 31, 1911	721,434.99
" JUNE 30, 1912	1,300,507.65
" DEC 31, 1912	1,636,209.45
" JUNE 30, 1913	1,694,051.30
" DEC. 31, 1913	1,721,486.13
FROM GENERAL FUND	$ 118,219.93
" 1909 BONDS	603,215.06



HETCH HETCHY WATER SUPPLY OF THE CITY AND COUNTY OF SAN FRANCISCO, CALIFORNIA

UPPER: GRAPHIC RECORDS OF COSTS OF LABOR AND MATERIALS.
LOWER: GRAPHIC RECORD OF NUMBER OF MEN EMPLOYED.

NOTE: EMPLOYEES IN THE SAN FRANCISCO OFFICES ARE NOT INCLUDED IN THE COUNT.

DEPARTMENT OF PUBLIC WORKS. APPROVED M. M. O'Shaughnessy ..... CITY ENGINEER
BY L.B.C. TRACED L.B.C. CHECKED .....
SCALE ..... DATE .....

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HETCH HETCHY WATER SUPPLY OF THE CITY AND COUNTY OF SAN FRANCISCO, CALIFORNIA

GRAPHIC RECORDS OF
ANNUAL AND TOTAL EXPENDITURES.

DEPARTMENT OF PUBLIC WORKS. APPROVED M. M. O'Shaughnessy ..... CITY ENGINEER
BY L.B.C. TRACED L.B.C. CHECKED .....
SCALE ..... DATE .....

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ILLUSTRATIONS AND DIAGRAMS—Continued

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